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ERRATA.

Page 35 line 49 before *"A. dorsalis"* insert *"A. vexans,"*
„ 113 „ 1 for "GEERNICK" read "GEERINCK"
„ 132 „ 12 „ "more" read "less"
„ 138 „ 36 „ *"simulans"* read *"stimulans"*
„ 168 „ 24 „ "to lice" read "by lice"
„ 187 „ 30 „ *"P. minutus* var. *niger*, Ann." read *"P. minutus* var. *niger*, Adl. & Theod."
„ 231 „ 31 „ *"T. latifacies* read *"T. latifascies"*
„ 254 5 lines from end for *"A. jeyporiensis*, Theo." read *"A. jeyporiensis*, James"

IMPERIAL BUREAU OF ENTOMOLOGY.

REVIEW

OF

APPLIED ENTOMOLOGY.

SERIES B.

VOL. XVII.] [1929.

EDITORIAL.

With the issue of a new volume of the *Review of Applied Entomology*, an opportunity arises to call the attention of readers to some changes in policy that have been made during the past year.

Owing to the great increase in quantity and complexity of the world's literature on Economic Entomology, it has been found necessary to restrict the potential growth of the monthly parts of the *Review*, if their contents are to be kept up to date, and it is obviously of the first importance that this should be so, It has, therefore, become advisable to notice certain classes of papers by titles only instead of issuing abstracts of them. At present these mainly comprise two classes: (1) systematic papers dealing with groups of insects that are potentially of economic importance; and (2) papers the contents of which have already been noticed in the *Review* in another form. This treatment of systematic papers on such groups of insects as, for example, Aphids, Coccids and mosquitos, is felt to be justified in view of the fact that these are already dealt with in detail in the *Insecta* part of the *Zoological Record*, which is prepared and published annually by the Bureau.

GALLIARD (H.). **Quelques Culicidés nouveaux pour la Corse, en particulier** *Culex impudicus* **Ficalbi.**—*Ann. Paras. hum. comp.*, vi, no. 4, pp. 451–454, 1 fig., 3 refs. Paris, 1st October 1928.

The author records the occurrence in Corsica of seven species of Culicines captured or determined since the publication of his previous paper [*R.A.E.*, B, xv, 113]. One of these, *Culex impudicus*, Fic., was previously recorded as *C. apicalis*, Adams, from which it cannot be distinguished in the larval stage. All the adults reared from larvae supposed to be those of *C. apicalis* proved to be *C. impudicus*, so that it is possible that the former does not occur in Corsica. The male genitalia of *C. impudicus* are described and figured.

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Missiroli (A.). **La prevenzione della malaria nel campo pratico. II. Relazione.** [The Prevention of Malaria in Practice. Second Report.]—*Riv. Malariologia*, vii, no. 4, pp. 413–455, 2 figs., 12 graphs. Rome, 1928. (With Summaries in Italian, p. 623, French, p. 624, English, p. 626, German, p. 627.)

In the past the reclamation in Italy of large areas resulted in a gradual reduction of malaria owing to a decrease of Anophelines and the adaptation of the remainder to cattle. It is possible by measures against Anophelines to render safe the occupation of malarious localities. Malaria decreases rapidly where such measures are carried out; in some cases 2–3 years suffice to ensure healthy conditions. In continuation of previous work [*R.A.E.*, B, xv, 230], extensive use was again made in 1927 of Paris green, the few failures being due to dusting in very windy weather, or in the afternoon, or just before or during rain. No injury to man or cattle was observed. As a rule, even breeding-places that seemed to be free from larvae were dusted periodically, because a careful examination would have cost more in time and labour. Previous estimates of the duration of larval development seem rather too long. In July and August in places exposed to sunshine, dusting is best done at 8-day intervals instead of every 10 days [*loc. cit.*], especially where *Anopheles superpictus*, Grassi, is concerned, its development being undoubtedly shorter than that of *A. maculipennis*, Mg. In some breeding experiments at a water-temperature of about 22° C. [71·6° F.] pupae appeared by the 12th day. The vegetable débris that is produced in reservoirs and other impounded waters, if trees and bushes are partly submerged when the dams are closed, gives rise to Anopheline breeding. If such a condition is avoided and the banks are adequately inspected, artificial basins are not a danger as regards malaria.

It is noteworthy that in South Italy with mild spring weather, *A. bifurcatus*, L., is only rarely found in stables, so that Grassi regarded it as essentially rural, while in North Italy it has become domestic owing to the inclement weather. It occurs only exceptionally in dwellings, however, inhabiting animal quarters almost exclusively.

Aeroplanes are considered of great value for dusting places otherwise inaccessible or where reasons of cost preclude other treatment of the breeding-places.

Barbieri (A.). **Sensibilizadores fluorescentes como larvicidas. Acción fotodinámica de la luz.** [Fluorescent sensitising Substances as Larvicides. The photodynamic Action of Light.]—*Riv. Malariologia*, vii, no. 4, pp. 456–463, 1 fig. Rome, 1928. (With Summaries in Italian, p. 623, French, p. 624, English, p. 626, German, p. 627.) Also in *4. Reun. Soc. argentina Pat. reg. Norte* [in] *Bol. Inst. Clin. quirurg.*, iv, no. 28–31, pp. 157–165. 1 fig. Buenos Aires, 1928.

In view of the recorded photodynamic or actinic action on organic protoplasm of certain fluorescent sensitising substances, the author decided to test their action on mosquito larvae in the presence of light. The results of several series of experiments are given. It was found that many sensitisers of the phthalein type, which act by absorbing actinic rays, have larvicidal power even in extremely dilute solutions. The most efficient was a mixture of Rose Bengal and

Erythrosin, even at a dilution of 1 : 1,500,000, in diffused sunlight. Direct sunlight or electric light renders the mixture more active. A dilution of 1 in 500,000 is recommended, or, in some cases, 1 in 1,000,000 (or 1 gm. in 1 cu. m. of water). The action should take place early in the day when the sun is at its brightest, and for this reason the substance should be dissolved the previous evening. Larvicidal action occurs within 24 hours, but cloudy weather delays it considerably. The pink colour can be removed by adding 1 part in 10,000 of hydrochloric or sulphuric acid, so that the water becomes available for domestic use. The water is not rendered poisonous, the effect is lasting, and the dyes are not volatile or odorous. As light, particularly sunlight, bleaches the solution and probably decreases its action, stock solutions should not be unduly exposed to it.

Beklemishev (V.) & Mitrofanova (Yu.).] Beklemischev (W.) & Mitrophanova (J.). **Sur l'écologie larvaire de l'***Anopheles maculipennis*, **Mg. (Quelques prémisses expérimentales.)**—*Riv. Malariologia*, vii, no. 4, pp. 464–483, 11 refs. Rome, 1928. (With Summaries in Italian, p. 623, French, p. 625, English, p. 626, German, p. 628.)

Continuing the investigations already reported [*R.A.E.*, B, xiv, 130] experiments, which are described in detail, were carried out in the summer of 1926 near Perm to ascertain if the larvae of *Anopheles maculipennis*, Mg., are really unable to develop in the water of certain peat bogs. While the results must be regarded as provisional, certain conclusions can be drawn. Both in these and in the preceding investigations the ecological factors acting on the larvae were the concentration of dissolved oxygen, the reaction of the surroundings, the specific properties of the water, and the quantity and quality of the food. None of these factors in nature causes the immediate destruction of the larvae. They can hatch and develop up to the first moult in the natural waters that are least favourable chemically (*i.e.*, those containing *Sphagnum*). They can reach the adult stage in spite of an insignificant content of dissolved oxygen. Insufficient food only retards development and decreases the percentage of the survivors, but some larvae develop, at least up to the fourth stage. The least favourable of natural foods (*Polytrichum*) causes the death of most of the larvae in the early stages, but some become adult. Thus the destructive action of all these factors does not prevent the larvae from reaching the first moult. The reason why they are not found in such waters is, it must be assumed, that the females do not oviposit ordinarily in places where the larvae cannot develop completely. The peat-bog waters free from *A. maculipennis* that were studied were an environment extremely unfavourable to the larvae. In the *Sphagnum* bog the chemical nature of the water played the chief part, while in the *Polytrichum* marsh the quality of the food is involved.

Considered as a whole, the problem is very complicated, the most important factors limiting the possibility of development are often not those that are most apparent at first sight (as for instance the decrease of oxygen). Further study is needed to show the methods by which natural conditions can be modified to render water unsuitable for the development of *A. maculipennis*. This will facilitate anti-larval work in arid zones where the elimination of certain waters, or their treatment

by oiling or poisoning, is not desirable. The most important problem, however, is to establish experimentally the factors influencing the choice of a place for oviposition by *A. maculipennis*.

MARTINI (E.). **Beiträge zur medizinischen Entomologie und zur Malaria-Epidemiologie des unteren Wolgagebietes.** [Contributions to the Medical Entomology and the Malaria Epidemiology of the Lower Volga Region.]—*Abh. Gebiete Auslandsk. Hamburg Univ.*, xxix, (Ser. D, Med., iii) xi + 134 pp., 14 pls., 21 figs., 3 maps, 36 refs. Hamburg, 1928, Friederichsen, de Gruyter & Co. m. b. H. Price *M*.12.

The studies recorded in this report were made in the district of Saratov, Lower Volga, in 1925, with a view to obtaining exact data on the mosquito fauna and on certain problems of the epidemiology of malaria. General notes are given on the habitat of the various mosquitos observed. A section on malaria includes discussions on Anopheline conditions and the outlook as regards the control of the disease. While it is possible that *Anopheles hyrcanus* var. *sinensis*, Wied., may occur in the Saratov district, it was not found by the author. *A. bifurcatus*, L., and *A. maculipennis*, Mg., were both observed, the latter being usually the only house and stable mosquito. It is predominantly nocturnal in habit and is probably the sole vector of malaria. Much of the information on these mosquitos has already been noticed [*R.A.E.*, B, xiii, 188; xiv, 159; xvi, 174]. There is little prospect at present of combating malaria along the Volga itself. In the meadow lands on one side, measures such as oiling, the use of larvicides, and draining are quite feasible in many cases. The planting of shade-trees at the edges of tanks and of reeds may discourage *A. maculipennis*. Mosquito control in the hilly districts should not be difficult. As malaria in Saratov in 1925 did not increase before July, it is possible that infections did not occur before June, so that apparently only the second and subsequent generations of *A. maculipennis* transmit the disease. In this case it would suffice for breeding-places to be rendered unsuitable from about 21st May onwards. The effects of even a large increase of mosquitos in early spring can be nullified by a severe restriction of the breeding-places later on, though the destruction of mosquitos in winter can have little practical effect.

The Tabanids observed included *Chrysops relictus*, Mg., very common and troublesome in June and July; *C. caecutiens*, L., occurring at the same period; *C. quadratus*, Mg.; *C. concavus*, Lw.; *Haematopota pluvialis*, L.; *Tabanus bovinus*, L.; *T. autumnalis*, L., and *T.* (*Therioplectes*) *tropicus*, Panz. The steppe is very poor in Tabanids as compared with Germany. Of other Diptera, *Stomoxys* was very troublesome at times. The only ticks found were *Dermacentor reticulatus*, F., which was very common, and *Argas persicus*, Oken, taken in fowl houses.

[MAL'TZEV (M. V.).] **Мальцев (M. B.). Observations on the Larval and Adult Stages of** *Anopheles claviger*, **Fabr.**—*A. maculipennis*, **Meigen, in Omsk in 1926.** [*In Russian.*]—*Russ. J. Trop. Med.*, vi, no. 6, pp. 363–371. Moscow, 1928.

This is a detailed account of observations in the laboratory of the Omsk Malaria Station in 1926 on the seasonal development of *Anopheles maculipennis*, Mg. (*claviger*, auct.). The females used for experiments

had hibernated in the laboratory, and at an average temperature of 16·8° C. [about 69° F.], oviposition began on the 10th May on the surface of boiled and slightly sweetened water. For later experiments bowls containing unsweetened boiled and unboiled water were also used, and the females preferred these, being evidently guided by taste. The eggs developed equally in different waters, hatching earlier when the temperature was higher. If they did not have sufficient food, the larvae died within 18–20 hours after hatching, and under laboratory conditions they sometimes fed on one another, but those bred in a wooden trough, in conditions as nearly natural as possible, developed normally into healthy adults. The larvae moult four times before pupation, developing under experimental conditions in 24–33 days. The pupal stage lasted from 2 to 5 days. The average period of the life-cycle from egg to adult was 34 days, the minimum being 21 days and the maximum 42. Unfertilised females did not suck blood.

Kudryavtzev (V. A.).] **Кудрявцев (В. А.). Malaria in artificially irrigated Areas of the Stalingrad Government.** [*In Russian.*] – *Russ. J. Trop. Med.*, vi, no. 6, pp. 372–376. Moscow, 1928.

This is an account of an inspection in June 1927 of the artificially irrigated areas of the Stalingrad Government. Larvae of *Anopheles maculipennis*, Mg., occurred in large numbers in pools formed by the irrigation channels, which contained clean water and were well covered with reeds. The necessity for a special malaria expedition to inspect these places and for energetic propaganda amongst the population is emphasised.

Danilov (B. A.).] **Данилов (Б. А.). Hibernation of the Adults of *Anopheles* in Villages in the Rice Region.** [*In Russian.*] – *Russ. J. Trop. Med.*, vi, no. 6, pp. 377–384, 29 refs. Moscow, 1928.

Rice plantations play a prominent part in relation to malaria in Central Asia, acting as breeding-places of Anopheline mosquitos. An expedition to one of the villages in the rice region was organised in January 1928 to determine the conditions under which the Anophelines hibernate. During previous work in the same place in 1925–27, the mosquitos recorded were *Anopheles maculipennis*, Mg. (*claviger*, auct.). *A. pulcherrimus*, Theo., *A. hyrcanus*, Pall., *A. bifurcatus*, L., and *A. superpictus*, Grassi.

Of the hibernating Anophelines found, 70·5 per cent. were *A. sacharovi*, Favr; *A. superpictus* only occurred together with this species. Hibernating Anophelines were not found in cold or, with a few exceptions, in well lighted buildings, nor in native dwellings, owing to the smoke from the fire places. Very few individuals were found hibernating in European houses, and they obviously preferred cattle sheds and closed barns. *A. sacharovi* preferred dark places and cracks, and *A. superpictus* open wooden parts of buildings. The condition of the hibernating mosquitos depended entirely on the kind of building; they became active as soon as the temperature rose. By the end of January the number of Anophelines decreased, owing to severe cold, which forced the mosquitos to hide in cracks. Various factors, such as proximity of breeding-places, type of building, warmth, and presence of cattle, influenced the choice of hibernating quarters, but which of these

becomes dominant depends on local conditions. Owing to the numerous cracks in the walls of the houses and sheds, fumigation against hibernating mosquitos cannot be effective.

[Korostelev (V. E.).] **Коростелев (В. Е.). An Experiment with Paris Green for the Control of the Larvae of** *Anopheles maculipennis*. [*In Russian.*]—*Russ. J. Trop. Med.*, vi, no. 6, pp. 385–389, 3 refs. Moscow, 1928. (With a Summary in German.)

A detailed account is given of laboratory and field experiments made in 1927 in the Ukraine with Paris green as a larvicide against *Anopheles maculipennis*, Mg. The poison consisted of 30–31 per cent. of copper oxide and 45–46 per cent. of arsenious acid. A solution of Paris green in ammonia gave similar results to the dust and distributed the poison satisfactorily. Under laboratory conditions the dust was applied at the rate of about 1 lb. to the acre of water surface. The larvae of *Anopheles maculipennis* died within 1½–2 hours after the application of Paris green and those of *Culex* (contrary to the observations of other workers) within 5½–6 hours, but the pupae remained unaffected. Field experiments were made on clear days with a light wind by hand-dusting certain areas of water with Paris green mixed with road dust, 1 : 40, and all larvae of *Anopheles* and *Culex* were killed. The dust should be applied every ten days, as this kills the larvae before pupation. Paris green did not affect any other inhabitants of the treated waters except the larvae of *Corethra*, all of which died. This measure is much simpler and considerably less expensive than oiling.

[Herman (O. A.), Kolosov (Yu. M.) & Lipin (N. M.).] **Герман (О. А.), Колосов (Ю. М.) и Липин (Н. М.). Is Paris Green suitable for the Destruction of the Larvae of Malaria Mosquitos?** [*In Russian.*] —*Kazansk. med. Zh.*, 1928, no. 8, pp. 780–785. Kazan, 1928.

The conclusions of F. I. Yatzenko as to the value of Paris green for the control of *Anopheles maculipennis*, Mg., [*R.A.E.*, B, xiv, 204] are questioned. Field observations, in continuation of preceding work [*R.A.E.*, B, xiv, 153], proved once more the greater efficiency of kerosene and crude oil. In cases where Paris green had little or no effect, oiling cleared the water of all stages of mosquitos for a considerable length of time. Usually Paris green had no effect on the larvae of Culicines, etc., which were destroyed by oiling. Culicines reappeared rather soon after oiling, in some cases in 10 or 11 days, but under the same conditions Anopheline larvae were only twice found 20 days after oiling. Paris green should only be applied when it is impossible to use oils, for example when the water contains fish or when it is used by cattle, though experiments are necessary to prove that the latter are not affected by the poison.

[Lebedeva (N. N.).] **Лебедева (Н. Н.). Some Observations on the Biology of Mosquitos.** [*In Russian.*]—*Russ. J. Trop. Med.*, vi, no. 7, pp. 431–433. Moscow, 1928.

This is a brief account of the work carried out during 1925–27 on the biology of *Anopheles maculipennis*, Mg., the only Anopheline found in Saratov and its surroundings. The years under review were very

unfavourable to it. A sudden fall of temperature in November 1925 killed most of the adults, so that none was found hibernating, and only small numbers were observed during the summer and autumn of 1926. In 1927, however, they became much more numerous, owing to a hot and rainy summer. Hardly any mosquitos were found in dwelling houses, but they were common in stables and cattle sheds, the majority containing blood.

[Bessonova (S. A.).] **Бессонова (С. А.). The Hibernation of Mosquitos in the Filter-beds of the Saratov Waterworks.** [*In Russian.*] — *Russ. J. Trop. Med.*, vi, no. 7, pp. 434–435. Moscow, 1928.

This is a short account of observations on mosquitos hibernating on the walls and in corners in the Saratov waterworks, and even on the dividing walls of the filter beds. The majority of those taken were Culicines, but *Anopheles maculipennis*, Mg., also occurred. The fact that no mosquitos were found in dwellings adjoining the waterworks showed that the latter offered very favourable conditions for the hibernation of the mosquitos, namely, continuous humidity, absence of snow and a suitable temperature. Fumigation cannot be applied in the waterworks, and collection of the mosquitos is very difficult owing to the construction of the filter-beds.

[Demina (N. A.) & Nikol'skiĭ (V. V.).] **Домина (Н. А.) и Никольский (В. В.). On the Development of the Larvae of *Anopheles maculipennis*, Mg., in Waters of various Chemical Composition and on the Selective Affinity of the Females at the Time of Oviposition in these Waters.** [*In Russian.*] — *Russ. J. Trop. Med.*, vi, no. 7, pp. 445–452, 1 ref. Moscow, 1928. (With a Summary in French.)

In the summer of 1927 experiments were carried out by the Hydrobiological Section of the Moscow Tropical Institute on the causes of the distribution of the larvae of *Anopheles maculipennis*, Mg., in various waters. Laboratory experiments, which are fully described, but which the authors do not consider decisive, showed that although acid waters with a comparatively high oxygen content and a low oxidation are not avoided by the female mosquitos for oviposition, the larvae in them soon die. The mosquitos do not normally oviposit in sphagnum waters of the colour of strong tea with a low oxygen content and a high oxidation, and if for some reason oviposition does occur there, the larvae very soon die. On the other hand, waters with a high calcium content are very favourable to the development of the larvae, even if nutritive elements are very scarce. Such waters are mostly preferred by females for oviposition.

[Voskresenskiĭ (B. V.) & Brenn (E. N.).] **Воскресенский (Б. В.) и Бренн (Е. Н.). Interrupted Irrigation of Rice Plantations in the Control of Malaria in Azerbaijan. (First Report.)** [*In Russian.*] — *Russ. J. Trop. Med.*, vi, no. 7, pp. 458–463, 2 refs. Moscow, 1928.

The rice-fields in Azerbaijan, which are irrigated by very slow running water 2–4·5 ms. deep and contain numerous pools, offer very favourable conditions for the breeding of Anophelines, in consequence of which the whole population of the region suffers from malaria. To control the disease, experiments with a view to changing the irrigation system

were carried out in 1926. Observations showed that under natural conditions the period of the development of Anophelines was 17–19 days in July and August, at average temperatures of 24·54°C. and 26·9°C. [about 76–81°F.], and 30 days in September at 18·9°C. [about 67°F.]. At the beginning of the season most of the mosquitos were *Anopheles maculipennis*, Mg., but by the end of August 70 per cent. of the larvae were those of *A. hyrcanus* var. *pseudopictus*, Grassi. Single individuals of *A. superpictus*, Grassi, occurred throughout the season, while *A. bifurcatus*, L., was first observed at the beginning of August. *A. maculipennis*, *A. hyrcanus* var. *pseudopictus* and *A. superpictus* can oviposit on the soil, and these eggs retain their vitality for five days and when wetted hatch in a few minutes. Therefore, when applying interrupted irrigation, the period of the development of Anophelines in water should be taken into consideration. The intervals between the irrigations should not be less than three days when the average temperature is 23–24°C. [73·4–75·2°F.] with a relative humidity of 52 per cent., but a four-day interval is recommended, especially with a view to killing not only the larvae of *Anopheles* but also those of *Aëdes*.

After the first interruption in the irrigation, the rice-fields were completely free from algae and floating plants, which did not reappear later. Within 18 to 48 hours after the irrigation, the treated fields contained larvae that had apparently hatched from eggs left on the ground by the receding water. The untreated rice-fields were inspected every seven days. Algae and various floating plants gradually increased, and 1 45 Anopheline larvae were taken from every square yard, the majority of them breeding amongst floating plants. The rice stems in treated plantations were only slightly smaller than those in the untreated ones, while weeds and fungus diseases were considerably less prevalent, and the rice began to form ears a week earlier, producing a better crop. The experiments proved that interrupted irrigation is a very satisfactory method of reducing the breeding of Anopheline mosquitos; the fields should be kept under water not more than 11–12 days between the four-day interruptions so as to prevent pupation, which may occur in damp soil.

[Dolbeshkin (B. I.).] **Долбешкин (Б. И.). Mosquitos of the Dnieper Region (Ukraine).** [*In Russian.*]—*C. R. Acad. Sci. U. R. S. S.*, 1928, no. 13, pp. 229–232. Leningrad, 1928.

This is a list of 26 species of mosquitos recorded during the period 1923–27 in the area of the tributaries of the Dnieper, with notes on their local and seasonal distribution. The Anophelines recorded are *Anopheles maculipennis*, Mg., *A. bifurcatus*, L., and *A. hyrcanus* var. *pseudopictus*, Grassi.

[Goritzkaya (V. V.).] **Горицкая (В. В.). The Infection of *Anopheles maculipennis*, Meig. (Diptera, Culicidae) with the Malaria *Plasmodium* under Natural Conditions.** [*In Russian.*]—*C. R. Acad. Sci. U. R. S. S.*, 1928, no. 13, pp. 233–236, 2 figs. Leningrad, 1928.

This is a short account of the work carried out in the Ekaterinoslav Government during 1924–1927, when a special study was made on malaria infection in *Anopheles maculipennis*, Mg. The number of infected mosquitos was much larger in dwelling houses than in cattle

sheds, the percentage being directly affected by the presence of infected persons. The first infected mosquitos were found at the end of May and contained mature oocysts ; the last occurred in the middle of November and contained oocysts and sporozoites.

[Burakova (L. V.).] **Буракова (Л. В.). Sandfly Fever and the Crimean Sandflies according to Records of the Expedition of the Academy of Science in 1927.** [*In Russian.*]—*C.R. Acad. Sci. U.R.S.S.*, 1928, no. 13, pp. 237–242, 1 fig. Leningrad, 1928.

Previous work carried out in Russia in connection with the study of *Phlebotomus* spp. as carriers of sandfly fever is briefly reviewed. This disease has been often recorded from the Crimea, the Caucasus and Turkestan, where it has frequently occurred in epidemic form amongst newly arrived troops. A special expedition to southern Crimea was therefore organised in 1927 to study the distribution and biology of *Phlebotomus*. Sandflies were bred under laboratory conditions, oviposition and all stages of the larvae being obtained. Sebastopol proved to be the main reservoir of the fever and the chief, if not the only place where *P. papatasii*, Scop., occurs, while in other parts of the Crimea, *P. perniciosus*, Newst., is the predominant species. With a view to determining the distribution of sandfly fever in the Crimea and its connection with the sandflies, a more energetic collection of the latter is recommended with a simultaneous registration of all infected persons.

Khodukin (N. I.). **Ходукин (Н. И.). Does *Anopheles algeriensis*, Theob., exist in Turkestan?** [*In Russian.*—*C.R. Acad. Sci. U.R.S.S.*, 1928, no. 13, pp. 243–245, 1 fig. Leningrad, 1928.

So far studies of the Anopheline fauna of Turkestan have not been complete. The author gives a detailed description of the characters of all stages of *Anopheles bifurcatus*, L., which was found in April 1928 in Turkestan and described as *A. algeriensis* var. *turkestani*, Shingarev *R.A.E.*, B., xiv, 129 . From the examination of a number of specimens the author concludes that *A. algeriensis*, Theo., does not occur in Turkestan.

Khodukin (N. I.). **Ходукин (Н. И.). Kala-azar in Tashkent in Connection with the Epidemiology of Leishmaniasis of Dogs.** [*In Russian.* *C.R. Acad. Sci. U.R.S.S.*, 1928, no. 13, pp. 246–250. Leningrad, 1928.

In connection with the spread of infantile kala-azar in Samarkand, a detailed study was organised in order to determine the vectors and the relation between the forms of the disease in children and in dogs. This work is fully described. Laboratory experiments showed that leishmaniasis is most prevalent in dogs in the spring, especially in May, while in November the percentage of infected dogs is very much less. It was found that kala-azar in children almost always coincided with cases of canine leishmaniasis. As a result of a systematic study the sandflies found in the Tashkent region were *Phlebotomus papatasii*, Scop., *P. perniciosus*, Newst., *P. sergenti*, Parrot, *P. li*, Popov, *P. major*, Annandale, *P. minutus*, Rond., and two varieties of the last-named.

The fleas, *Pulex irritans*, L., *Ctenocephalus canis*, Curt., *C. felis*, Bch., and *Echidnophaga gallinacea*, Westw., were found on dogs. Dissections of the first three of these fleas were made from January till September 1926, but none were found to harbour infection.

Dissections showed that natural infection of the sandflies with Herpetomonads was very rare. During the summer of 1927 about 600 sandflies of various species were fed on the ears of infected dogs. A third of the sandflies died before dissection and of the remainder 2·8 per cent. were found to contain Herpetomonads. These remained in the digestive organs of the insects for about ten days. The first flagellate was found on the fourth day, the majority occurring on the sixth day of the experiments at a temperature of 23–26° C. [73·4 - 78·8° F.]. None of the sandflies not fed on dogs contained Herpetomonads. The low percentage of infection is probably explained by the fact that the sandflies used included *P. sergenti*, which has been shown by previous authors to be immune from infection by *Leishmania* (*Herpetomonas*) *donovani*, and that the concentration of the organisms is much less than in the lesions of dermal leishmaniasis. The author thinks that the Tashkent sandflies may be carriers of leishmaniasis in dogs. The necessity of studying the part played by various species of *Phlebotomus* in the spread of infantile kala-azar is emphasised.

YAMADA (S.). **An experimental Study on twenty-four Species of Japanese Mosquitoes regarding their Suitability as intermediate Hosts for** *Filaria bancrofti* **Cobbold.**—*Sci. Rep. Govt. Inst. Infect. Dis. 1927*, vi, pp. 559–622, 3 pls., 63 refs. Tokyo [1928].

Previous work on the development of *Filaria bancrofti* in mosquitos in various parts of the world is reviewed. The development of this Nematode in *Culex pipiens* var. *pallens*, Coq., which the author considers to be a typical intermediate host, is described, the observations having been made when the laboratory temperature was 24–27° C. [75·2 - 80·6° F.]. The author considers that *F. bancrofti* is in the embryonic stage when ingested by the mosquito and until about two hours after ingestion, when it casts its sheath; he observed two ecdyses of the larvae subsequent to this, the first generally 7 and the second 11 days after. Immediately after casting their embryonic sheaths, the larvae migrate from the stomach of the mosquito to the general body cavity and thence to the thoracic muscles, which they reach in 6–16 hours. When full-grown, the larvae migrate to the labium, either directly, or more often after first entering the abdomen and moving about in the body cavity for a short while; this migration occupies 12–24 hours, and the larvae are ready to emerge from the labium on the 15th day after ingestion.

All the mosquitos with which experiments, details of which are given, were carried out, occur in Japan, with the exception of *Aëdes chemulpoensis*, Yam., which is confined to Korea. The mosquitos are divided into three categories, those in which the filarial larvae did not develop at all, those in which partial development took place and those in which complete development took place. The first category is subdivided into three groups: the first contains *Rachionotomyia bambusa*, Yam., in which the filarial larvae died in the stomach; the second contains *Aëdes koreicus*, Edw., *A. vexans* var. *nipponi*, Theo., *A. sticticus*, Mg., and *A. imprimens*, Wlk., in which they penetrated into the body cavity,

where they soon died; the third contains *A. esoensis*, Yam., *A. japonicus*, Theo., *A. dorsalis*, Mg., and *Anopheles sineroides*, Yam., in which some filarial larvae reached the thorax, although all died without showing morphological change. The second category is also subdivided into three groups: the first contains *Culex annulus*, Theo., *Aëdes esoensis* var. *flavus*, Yam. (MS.), *A. albopictus*, Skuse, *A. albolateralis*, Theo., and *A. galloisi*, Yam., in which the filarial larvae began to develop but did not get beyond the first stage; the second contains *A. chemulpoensis* and *Culex bitaeniorhynchus* var. *karatsuensis*, Mochizuki, in which development ceased in the second larval stage; the third contains *Armigeres obturbans*, Wlk., in which development proceeded up to the beginning of the third stage. The third category contains seven species; in three of these, *viz.*, *Anopheles hyrcanus* var. *sinensis*, Wied., *Culex tritaeniorhynchus*, Giles, and *C. sinensis*, Theo., less than 20 per cent. of the filarial larvae completed their development; the percentages of completed development in the other four were *C. whitmorei*, Giles, 68·3, *C. tipuliformis*, Theo., 81·8, *C. pipiens* var. *pallens*, 83·8, and *Aëdes togoi*, Theo., 96.

The author considers that the above results show that the ability of various mosquitos to transmit *Filaria bancrofti* has no relation to their systematic position; consequently the suitability of each species as an intermediate host of this Nematode must be determined experimentally. It appears that *F. bancrofti* is injurious to the mosquitos in which it develops, and it is possible that the latter have become resistant to it in varying degrees. The seven species of mosquitos in which the filarial larvae completed their development all occur commonly in houses in Japan, *Aëdes togoi* and *Culex pipiens* var. *pallens* especially being domestic species.

Meleney (H. E.), Lee (C. U.) & Yang (Ching-po). **Experiments with Anti-mosquito Measures at Yenching.**—*China Med. J.*, xlii, no. 10, pp. 725–736, 6 figs., 1 map, 6 refs. Shanghai, October 1928.

A study carried out in the neighbourhood of Peking in the summer of 1927 revealed the presence of 17 species of mosquitos, including two Anophelines, *Anopheles hyrcanus* var. *sinensis*, Wied., and *A. pattoni*, Christ. The characters distinguishing the adults and larvae of these two species are indicated. The larvae of *A. pattoni* first appeared on 14th June, while those of *A. hyrcanus* were first found on 28th June, after which date they increased rapidly and were found almost exclusively until September, when *A. pattoni* reappeared and the two species were present in almost equal numbers. Most of the information given concerning the breeding habits of these two mosquitos and the preventive measures employed against them has already been noticed (*R.A.E.*, B, xv, 184; xvi, 42). The relation to malaria of *A. pattoni* and, as regards North China, of *A. hyrcanus* var. *sinensis* has not been definitely ascertained, but the development of the malarial parasite has been demonstrated in both species as far as the sporozoite stage in the salivary glands.

The first cases of malaria occurred in February, the numbers increasing gradually during March and April, and more rapidly in June, July and August, all cases being of the benign tertian type. As no Anopheline larvae were found before 14th June, it is evident that latent malaria had previously appeared among the inhabitants in the form of spring relapses, thus preparing the way for the new generation of mosquitos to propagate the disease. Spleen examination among children showed

10·4 per cent. of enlarged spleens apparently due to malaria, the importance of which as an endemic disease in the neighbourhood of Peking is thus demonstrated.

ASERAPPA (C.V.). **Mosquito Prevention.**—*Rep. Med. Off. Hlth. Colombo 1927*, xxii, pp. 38–39. Colombo, Ceylon [1928].

Mosquitos found breeding in and near Colombo in 1927 included *Anopheles hyrcanus* var. *sinensis*, Wied., an influx of which occurred early in the year, and *A. listoni*, List. Several authentic cases of malaria have been reported as contracted in Colombo by persons who have never before been in any recognised malarial district, and more than one epidemic has been reported from quarries situated just outside the southern limits of the town.

[KINGSBURY (A. N.).] **Annual Report of the Institute for Medical Research for the Year 1927.**—*Rep. Med. Dept. F. M. S. 1927*, pp. 32–57. Kuala Lumpur, 1928.

Two probable cases of tsutsugamushi disease occurred in Malaya in 1927. The local vector is further discussed [*cf. R.A.E.*, B, xvi, 101, 261]. Observations on the seasonal occurrence of *Trombicula deliensis*, Walch, in the Malay States, indicate that its life-cycle is parallel with that of *T. akamushi* in Japan.

Aëdes argenteus, Poir., and *A. albopictus*, Skuse, fed on guineapigs showing *Leptospira icterohaemorrhagiae* in the peripheral blood, failed to infect healthy guineapigs, and dissection of the surviving mosquitos failed to show *Leptospira*.

[KINGSBURY (A. N.).] **The Malaria Research Division (Malaria Bureau).**—*Rep. Med. Dept. F. M. S. 1927*, pp. 58–62. Kuala Lumpur, 1928.

Investigations were made into the variation in the prevalence of mosquitos at different stages of the rice crop, based on collections of larvae taken from the rice-fields of Negri Sembilan from September 1926 to June 1927. *Anopheles fuliginosus*, Giles, *A. hyrcanus* var. *nigerrimus*, Giles, and *A. barbirostris*, Wulp, were present throughout the period. The rice is planted out in September, and the maximum concentration of larvae, which occurs in October, is largely due to the dominance of *A. fuliginosus*. *A. hyrcanus* var. *nigerrimus* and *A. barbirostris* reached their maximum concentration in November. These three species decreased in numbers until after the harvest in February, when an increase was again noticeable. *A. aconitus*, Dön., was not found until the end of November, after which it increased rapidly until just before the harvest, when it was the dominant species. It persisted for some time after the harvest, then rapidly diminished in numbers and would probably have disappeared during July and August. This species was usually found in flowing water, but 20 per cent. of the captures were made in stagnant water and in some cases in water that was definitely foul with decaying stubble. When small pools appeared at harvest time, *A. kochi*, Dön., was found in association with *A. vagus*, Dön. At the same time *A. maculatus*, Theo., was found breeding in two fields; this was caused by fresh water from wells outside the field flowing into them and indicates a possible danger from

this source. The sudden increase in the numbers of Anophelines after the rice is planted out can be accounted for by the fact that the natural enemies of the larvae have not developed sufficiently to keep them in check. As the crop matures, the natural enemies increase, and quite apart from changes affecting the breeding of individual species, the Anophelines decrease until an approximate balance is reached. All the species mentioned, with the addition of *A. karwari*, James, were found breeding outside the rice-fields. *A. kochi* and *A. vagus* were found in buffalo wallows in large numbers throughout the period, while *A. maculatus* was taken in every month except October. *A. aconitus* was only found outside the rice-fields when it was also breeding vigorously within them. From adults caught in houses it would appear that *A. fuliginosus*, *A. hyrcanus* var. *nigerrimus* and *A. barbirostris* are not house-loving species, while *A. vagus* and *A. aconitus* are. *A. maculatus* was not taken once, although it was known to be breeding at that period. Females of *A. aconitus* were found in houses from September to the end November although no breeding took place in the fields; either these individuals live through the non-breeding season and there is a definite periodicity in breeding, or they come from breeding-places at some considerable distance. Females of all species were dissected, but no malaria parasites were discovered, although all have been infected experimentally, and all have been found naturally infected in Malaya with the exception of *A. kochi* and *A. vagus*.

Dissections of 721 adults found in houses in Petaling village showed negative results except in the case of two individuals of *A. aconitus* in which oocysts were found. Several specimens of *A. aconitus* also harboured Trypanosomids, showing *Crithidia* forms in the mesenteron and *Leishmania* forms in the proctodeum.

Entomological Notes.—*Ann. Med. & San. Rep. Gambia 1927*, p. 20. London, 1928.

Mosquitos caught at Cape St. Mary were identified as *Anopheles funestus*, Giles, and *A. gambiae*, Giles (*costalis*, Theo.). Mosquitos identified as *Aëdes* (*Aëdimorphus*) *punctothoracis*, Theo., were found breeding in yard and street pools in August. Flies identified as *Chrysomyia marginalis*, Wied., *C. albiceps*, Wied., and *Sarcophaga* sp. were suspected by the natives of being the vectors in an outbreak of cattle sickness (pleuro-pneumonia), although they are not known to play any part in the carriage of *Asterococcus mycoides*.

Bauer (J. H.) & Hudson (N. P.). **Passage of the Virus of Yellow Fever through the Skin.**—*Amer. J. Trop. Med.*, viii, no. 5, pp. 371–378, 1 ref. Baltimore, Md., September 1928.

Experiments are described in which, in some cases, monkeys (*Macacus rhesus*) were infected with yellow fever by rubbing drops of blood from infected monkeys on either unbroken or slightly scarified skin; one monkey also developed a fatal infection as the result of having a drop of a suspension of infected individuals of *Aëdes argenteus*, Poir. (*aegypti*, L.) rubbed into a scarified area on the abdomen. No infection resulted in two cases in which drops of the suspension were rubbed on unbroken skin, or in two cases in which infective blood was placed in the conjunctival sac or in the mouth. It appears that the virus of yellow fever is more concentrated in the blood of man or an experimentally infected

animal in the early stages of the disease ; individuals of *A. argenteus* fed on a patient 12 hours after the onset of the disease became infective, but others fed 24 hours later failed to do so, although the virus was still present in the blood, as was proved by inoculation.

DAVIS (N. C.) & SHANNON (R. C.). **The Blood Feeding Habits of *Anopheles pseudopunctipennis* in Northern Argentina.**—*Amer. J. Trop. Med.*, viii, no. 5, pp. 443–447, 4 refs. Baltimore, Md., September 1928.

The results are given of the examination by the precipitin test of the blood contained in 652 out of over 1,600 females of *Anopheles pseudopunctipennis*, Theo., captured in houses in two localities in the province of Tucumán, northern Argentina, from April to June 1926, the majority being taken in April. Of 581 specimens with which positive results were obtained, 50 per cent. had fed on man, 21·8 per cent. on dogs, 8·9 per cent. on horses, 6·2 per cent. on sheep or goats, 5·5 per cent. on cattle, 3·2 per cent. on fowls, 2·5 per cent. on pigs and 1·8 per cent. on cats.

SHANNON (R. C.) & DEL PONTE (E.). **Los Culicidos en la Argentina.**—*Rev. Inst. bact.*, v, no. 1, pp. 29–140, 14 figs., 14 pp. refs. Buenos Aires, November 1927. [Recd. 1928.]

This is a systematic revision of the Argentine CULICIDAE with keys and notes on the species, sixteen of which are new. Particular attention is devoted to the Anophelines, keys being given to the adults, based on the male genitalia and on other characters, and to the larvae. The various species are described, with, in many cases, notes on their distribution, breeding-places and relation to malaria. They include *A. perezi*, sp. n., which occurs in Jujuy and Tucumán.

Extensive bibliographical lists are given on some of the tribes and on the species of the genus *Anopheles*.

SHANNON (R. C.) & DEL PONTE (E.). **Sinopsis parcial de los muscoideos argentinos. (Addenda et corrigenda.)** [A Classification of some Argentine Muscoidea.]—*Rev. Inst. bact.*, v, no. 1, pp. 141–147. Buenos Aires, November 1927. [Recd. 1928.]

These additions and corrections to a paper published under this title [*R.A.E.*, B, xvi, 12] are based on the opinions of J. R. Malloch and J. M. Aldrich. A revised key is given to the Muscoid flies of Argentina.

DA COSTA LIMA (A.). **Sobre algumas anophelinas encontradas no Brasil.** [On some Anophelines found in Brazil.]—*Sciencia med.*, vi, nos. 7 & 8, pp. 334–341, 406–411, 10 figs., 6 pls. Rio de Janeiro, 1928.

This paper continues a study of Brazilian Anophelines of the *Nyssorhynchus* group [*R.A.E.*, B, xvi, 215]. The author regards *Nyssorhynchus* as a distinct genus and divides it into two subgenera : *Nyssorhynchus* (*Cellia* of Brazilian authors) and *Kerteszia*. He divides his subgenus *Nyssorhynchus* into two groups. The first comprises species in which the last three tarsal joints of the hind legs are completely white, and the second species in which these joints are white ringed

with black. The species here dealt with belong to this latter group. *Anopheles albimanus*, Wied., may occur in Brazil, but existing records almost certainly refer to other species. *A. tarsimaculatus*, Goeldi, is common throughout the Neotropical region and is considered an important vector of malaria. *A. tarsimaculatus* var. *oswaldoi*, Peryassú, is considered a distinct variety. *A. bachmanni*, Petrocchi, was taken in Rio de Janeiro; it occurs in Argentina, Paraguay, Brazil, Venezuela, and Dutch Guiana. Its morphology is dealt with at length. *A. strodei*, Root, taken in S. Paulo, is considered distinct from *A.* (*Cellia*) *evansi*, Bréthes, which is perhaps identical with *A. tarsimaculatus*. Its larvae resemble those of *A. tarsimaculatus*, but differ in certain characters. The pupae are practically indistinguishable from those of *A. albimanus* and *A. tarsimaculatus*.

All the above species have one black ring at the base of the last tarsal joint. The following have more than one black ring in the white area of the hind tarsi: *A. rondoni*, Neiva & Pinto, taken in Argentina, but not found infected with malaria; and *A. cuyabensis*, Neiva & Pinto, which closely resembles *A. bachmanni* except for a white area on the hind tarsus.

COLLIER (W. A.). **Durch Protozoen verursachte Krankheiten im Llanosgebiet Venezuelas.** [Diseases in the Plains Region of Venezuela due to Protozoa.] —*Arch. Schiffs- u. Tropenhyg.*, xxxii, no.1 0, pp. 489–494. Leipzig, October 1928.

Malaria is widespread in the plains region of Venezuela and is, as also in the hills, the principal disease. All the Anophelines discussed are vectors, though of varying importance. The chief vector is *Anopheles albimanus*, Wied., which occurs throughout the plains together with *A. argyritarsis*, R.-D., which has the same habits and comes next in importance as a carrier. *A. maculipes*, Theo., is widespread, but not common. *A. punctimacula*, D. & K., which is common in the hills, was found once. *A. pseudopunctipennis*, Theo., and *A. mediopunctatus*, Theo., are common; the latter is especially found in farms, biting only in the twilight and at night, but does not readily attack man. *A. tarsimaculatus*, Goeldi, and *A. punctipennis*, Say, also occur; the latter, though usually regarded as a forest mosquito, is common in houses in certain States. Breeding-places abound in the plains, particularly after the yearly floods, which are very extensive. Quinine prophylaxis and screening are the only means available against malaria.

Yellow fever appears to have been stamped out in Venezuela, though *Aëdes argenteus*, Poir. (*Stegomyia calopus*, Mg.) is widespread and common.

HOFFMANN (C. C.). **Contribución al conocimiento del Paludismo y de sus Transmisores en el Estado de Sinaloa.** [A Contribution to the Knowledge of Malaria and its Vectors in the State of Sinaloa, Mexico.] —*Bol. Dept. Salubridad publ.*, 1928, no. 1, pp. 31–46, 1 map, 6 figs., 4 refs. Mexico, 1928.

On the west coast of central Mexico fewer species of Anophelines occur than on the east coast [*R.A.E.*, B, xv, 198], only two, *Anopheles albimanus*, Wied., and *A. pseudopunctipennis*, Theo., being found in dwellings or as larvae in September and October 1926. In view of its adaptation to dry climates, *A. pseudopunctipennis* is the predominant

species throughout the major portion of the State. The progress of agriculture (involving irrigation) has in some places led to a more extensive distribution of Anophelines and consequently of malaria. The presence of green algae is essential for the larvae of *A. pseudopunctipennis*, and clean, clear water is preferred.

HOWARD (L. O.) & BISHOPP (F. C.). **Mosquito Remedies and Preventives.**—*Fmrs.' Bull. U. S. Dept. Agric.*, no. 1570, 12 pp. Washington, D. C., August 1928.

This revision of a bulletin previously noticed [*R.A.E.*, B, vi, 69] contains a few additional paragraphs on phases of mosquito control that have been studied in recent years, including the use of sprays of kerosene and pyrethrum extract against the adults in buildings, dusting with Paris green against the larvae, and impounding water.

GABLE (C. H.). **Bats as a Solution of Insect Problems.**—*Better Fruit*, xxiii, no. 4, pp. 5–7. Portland, Oregon, October 1928.

Arguments advanced in this paper against the employment of bats as a means of controlling insect pests include their wide range of activity, which carries them long distances from the roost ; the fact that only three out of the 260 species of bats occurring in North America congregate in sufficient numbers to form extensive colonies ; and the confinement of these species to the southern States and California as far north as the Sacramento Valley. The claim that these bats migrate north in the summer is stated to be unfounded. The most careful gathering of data has failed to establish the fact that bats destroy sufficient numbers of mosquitos to justify classifying them as a controlling factor of either the mosquito or malaria. Although inspection of five bat roosts, all established for a number of years, has shown that no certain method has yet been devised of persuading bats to colonise roosts erected in any desired situation, one such roost has been successfully colonised, and the possibility that further study may discover a means of establishing such colonies throughout the range of the species having this peculiar colonising habit must be admitted. In the meantime it should be remembered that experiments up to the present promise nothing but disappointment and involve a very large expenditure.

SERGENT (Edm. & Et.), FOLEY (H.), PARROT (L.) & CATANEI (A.). **Les principes de l'assainissement antipaludique.**—*Arch. Inst. Pasteur Algérie*, vi, no. 1, pp. 14–17. Algiers, March 1928.

In this brief review of anti-malarial measures, the importance of mosquito control is insisted upon. Where the breeding-places cannot be dealt with by drainage, etc., water must not be allowed to remain stagnant for more than 15 days, *i.e.* less than the time required for larval development of Anophelines in Mediterranean countries. If it is impossible to prevent the water from remaining stagnant, such measures as oiling, clearing of weeds and stocking with larvicidal fish must be resorted to. Running water, deep reservoirs empty of vegetation, and polluted water do not constitute breeding grounds for Anophelines.

PARROT (L.). **Notes sur les Phlébotomes. II. Sur quelques Phlébotomes de la Bokhara (U.R.S.S.).**—*Arch. Inst. Pasteur Algérie*, vi, no. 1, pp. 26–34, 7 figs., 4 refs. Algiers, March 1928.

Species of *Phlebotomus* described from various localities in Bokhara include *P. minutus* var. *sogdianus*, n., *P. major* var. *longiductus*, n., *P. sergenti*, Parr., and *P. li*, Popov, which the author regards as a variety of *P. sergenti*.

SENEVET (G.). **Clé pour la détermination des larves d'Ixodidés trouvées sur les bovins en Algérie.**—*Arch. Inst. Pasteur Algérie*, vi, no. 1, pp. 42–46, 10 figs. Algiers, March 1928.

This key to the Ixodids found on cattle in Algeria includes *Ixodes ricinus*, L., *Hyalomma mauritanicum*, Senevet, *H. lusitanicum*, Koch, *H. aegyptium*, L., *Haemaphysalis cinnabarina punctata*, C. & F., *Rhipicephalus sanguineus*, Latr., *R. bursa*, C. & F., and *Boophilus* (*Margaropus*) *annulatus calcaratus*, Newm., as well as *Dermacentor reticulatus*, F., which may occur on imported cattle.

SERGENT (Ed.), DONATIEN (A.), PARROT (L.) & LESTOQUARD (F.). **Sur la lutte biologique contre la piroplasmose bovine due à *Theileria dispar*.**—*C. R. Acad. Sci. Fr.*, clxxxvii, no. 8, pp. 433–434, 1 ref. Paris, 1928.

Unlike all other known Ixodids, *Hyalomma mauritanicum*, Senevet, which transmits bovine piroplasmosis caused by *Theileria dispar* in Algeria [*R.A.E.*, B, xvi, 267], is found in buildings and not in fields. All cracks and crevices in stables, yards, etc., that might harbour the ticks should, therefore, be filled in. Since this tick also attacks horses, which are immune from the disease, stables should be occupied in turn by horses and cattle for a year at a time in order that the ticks may exhaust the infection on the horses and thus be rendered harmless to cattle in the following year.

NICOLLE (C.), MATHIS (C.) & ANDERSON (C.). **Sur l'unicité des spirochètes récurrents du groupe Dutton.**—*C. R. Acad. Sci. Fr.*, clxxxvii, no. 16, pp. 631–632. Paris, 1928.

The spirochaetes that cause relapsing fever, although identical morphologically, show a general tendency to differ from one another. The authors give some examples of this fact [*R.A.E.*, B, xvi, 160, 219], but point out that experiments carried out at Tunis and at Dakar [B, xvi, 265] show that *Spirochaeta duttoni* has always identical characters, whatever its country of origin or vertebrate host and, probably, whatever the transmitting agent.

NICOLLE (C.) & ANDERSON (C.). **Un nouveau spirochète récurrent, pathogène pour le cobaye, *Sp. sogdianum*, transmis par *Ornithodorus papillipes*.**—*C. R. Acad. Sci. Fr.*, clxxxvii, no. 18, pp. 746–748. Paris, 1928.

Although most of the spirochaetes causing relapsing fever show little or no virulence to guineapigs, *Spirochaeta hispanica* and its variety, *marocana*, cause true relapsing fever in these animals. The authors

isolated from *Ornithodorus papillipes*, Bir., from Russian Turkestan, another spirochaete, *S. sogdiana*, sp. n., which they found to be also extremely pathogenic to guineapigs, somewhat so to a monkey infected by inoculation, and very slightly so to white mice and rats, whether bitten by infected ticks or inoculated. Cross-immunity tests showed *S. sogdiana* to be distinct from *S. hispanica* or its variety and from *S. duttoni* and *S. normandi*. It was successfully transmitted by *O. moubata*, Murr., and *O. normandi*, Larr., previously infected as nymphs, but was not transmitted from the infected monkey to a healthy one by lice [*Pediculus*].

Legendre (J.). **La psychologie de** *Culex pipiens*.—*C. R. Acad. Sci. Fr.*, clxxxvii, no. 18, pp. 774–776. Paris, 1928.

Culex pipiens, L., usually lays its eggs 4–6 days after feeding, but if the water necessary for the larvae is lacking, oviposition is deferred. The author found that the females could delay oviposition for 25–30 days in dry conditions; then, if allowed access to water, they all laid their eggs within 48 hours. Hatching took place in the normal 48 hours.

Nicolle (C.), Anderson (C.) & Colas-Belcour (J.). **Etude expérimentale du spirochète sanguicole du gondi.**—*C. R. Acad. Sci. Fr.*, clxxxvii, no. 19, pp. 790–791. Paris, 1928.

Spirochaeta gondii was found in the blood of *Ctenodactylus gondi* in May 1928 in South Tunisia. The infection caused in this rodent and in mice is very slight. Rats, guineapigs, *Meriones shawi* and monkeys are all refractory. Cross-immunity tests showed this spirochaete to be distinct from *S. normandi* and *S. hispanica* var. *marocana*. It is probably transmitted in nature by a species of *Ornithodorus* found on *C. gondi*; attempts to transmit it experimentally by *O. moubata*, Murr., *O. savignyi*, Aud., and *O. marocanus*, Velu, were unsuccessful.

Nicolle (C.), Anderson (C.) & Colas-Belcour (J.). **Premiers essais d'adaptation du spirochète des poules à divers ornithodores.**—*C. R. Acad. Sci. Fr.*, clxxxvii, no. 19, pp. 791–792. Paris, 1928.

In experiments *Ornithodorus moubata*, Murr., *O. normandi*, Larr., and *O. marocanus*, Velu, failed to transmit *Spirochaeta gallinarum* to fowls seven days after the infecting feed. The ticks were then crushed, and the fowls inoculated with them. Infection was only produced in the case of *O. marocanus*. An attempt to infect with *Spirochaeta hispanica* nymphs of *Argas persicus*, the vector of *S. gallinarum*, was unsuccessful.

Brumpt (E.) & Neveu-Lemaire (M.). **Travaux pratiques de parasitologie.**—Cr. 8vo, vi+301 pp., 202 figs. Paris, Masson & Cie., 1929. Price *Frs.* 30.

The object of this book is to provide medical students with a practical guide for laboratory work in human parasitology, together with notes on the collection of specimens. A brief introduction to the subject, in

which the authors define the types of parasitism and the principal groups of parasites, is followed by nine chapters on animal parasites and one on fungi. Brief accounts are given of the morphology, biology and relation to disease of the more important species or groups. The first chapter deals with blood-sucking and myiasis-producing Diptera, and the second with the remaining groups of parasitic Arthropods.

Metcalf (C. L.) & Flint (W. P.). **Destructive and Useful Insects. Their Habits and Control.**—8vo, xii+918 pp., 561 figs. New York & London, McGraw-Hill Pubg. Co. Ltd. Price 37*s.* 6*d.*

A section of this textbook, which is reviewed elsewhere [*R.A.E.*, A, xvii, 29], deals with the insects, mites and ticks affecting the health of man and animals in the United States. Field keys are given for the identification of the groups or sometimes the species of pests attacking man, various domestic animals, and poultry; and the life-history, appearance and habits of each are described, with practical suggestions for their control. References are given to the literature on the subject of each pest.

Edwards (F. W.). **Nematocera.**—*Insects of Samoa*, pt. vi, fasc. 2, pp. 23–102, 20 figs. London, Brit. Mus. (Nat. Hist.), 23rd June 1928.

Among the 7 Culicines dealt with in this account of the Nematocera of Samoa are *Aëdes argenteus*, Poir., and *A. variegatus* var. *pseudoscutellaris*, Theo.

Of the 16 Ceratopogonids recorded, 11 are new. None of these was observed to suck blood, but the midges of the genera *Culicoides* and *Lasiohelea*, one new species of each of which is described, will probably be found to do so.

Buxton (P. A.). **Siphonaptera.**—*Insects of Samoa*, pt. vii, fasc. 2, pp. 53–54. London, Brit. Mus. (Nat. Hist.), 23rd June 1928.

The fleas recorded from Samoa are *Xenopsylla cheopis*, Roths., on *Mus rattus*, *M. norvegicus* (*decumanus*) and *M. exulans*, *Ctenocephalus felis*, Bch., on dogs and cats, and *Pulex irritans*, L.

Buxton (P. A.). **Anoplura.**—*Insects of Samoa*, pt. vii, fasc. 3, pp. 85–86, 3 refs. London, Brit. Mus. (Nat. Hist.), 28th July 1928.

The following lice are recorded from Samoa: *Pediculus capitis*, DeG.; *Phthirus pubis*, L., many of which were infesting the eye-lashes of children; *Haematopinus suis* var. *adventicius* Neum., on pigs; and *Polyplax spinulosa*, Burm., on *Mus* (*Rattus*) *rattus*. *Hoplopleura pacifica*, Ewing, has previously been recorded on *M. exulans*.

Pearse (A. S.). **Fleas found on Rodents and Insectivores in Nigeria.**—*Bull. Ent. Res.*, xix, pt. 2, pp. 167–169. London, October 1928.

The fleas collected from rodents and insectivores in Nigeria during the latter part of 1926 are recorded, and their association with various types of country is discussed. No plague infection was found but *Xenopsylla cheopis*, Roths., was taken on various rodents as well as

on *Crocidura manni*. The results indicate that in Southern Nigeria, where the climate is very wet, fleas do not commonly occur except on house rats, while in the north, where the climate is dry, there are many fleas but plague has not yet been introduced.

MOUTIA (A.). **Surra in Mauritius and its Principal Vector,** *Stomoxys nigra*. **Part I.**—*Bull. Ent. Res.*, xix, pt. 2, pp. 211–216. London, October 1928.

The first outbreak of surra in Mauritius occurred in cattle and equines in 1901, and it is now endemic throughout the Island. It exists all the year round, but is most prevalent from October to March, which is the period of most intensive work for animals and coincides with the summer occurrence of biting flies. Collections of these flies were made in various localities at different times of the year, and the only one commonly observed was *Stomoxys nigra*, Macq. Since *S. calcitrans*, L., a closely allied species, has been proved to be a vector of surra in other countries, there was little doubt that *S. nigra* carried the disease in Mauritius, and experiments were therefore undertaken to obtain actual proof, and to ascertain whether development of the parasite, *Trypanosoma evansi*, took place in the fly.

The female lays its eggs singly or in masses, usually on bovine excreta in the field and rarely on manure heaps, the number laid varying from 60 to 125. The larvae hatch in 2–3 days and reach maturity 14–18 days later; pupation occurs in the ground, usually under the pads of cow dung, and the adults emerge in 11–14 days at a temperature of 25–30° C. [77–86° F.]. After a full meal of blood, the flies can remain alive without further feeding for 3–4 days, and they can be kept alive in captivity in tubes on two meals a day for as long as 8 days, with an average of 5. In order to provide material for these experiments young larvae reared from eggs were fed on cow dung kept moist, while the adults were fed on healthy guineapigs twice a day, the feeding lasting 4–10 minutes. Females reared in captivity laid eggs on the 8th day. The insect takes its first food only 24 hours after emergence.

Details of the transmission experiments are given, and the following results are taken largely from the author's summary. *Stomoxys nigra* transmits surra directly by feeding on an infected animal with trypanosomes in the peripheral blood, and immediately afterwards feeding on a healthy animal, but the interval between feeds must not be more than 10 minutes. Trypanosomes are found active in the proboscis of the fly from 1 to 10 minutes after a meal, when the room temperature is between 25 and 27° C. [77 and 80·6 ° F.]. No active or developmental forms of the trypanosome were found in the gut, Malpighian tubes or salivary glands of the fly 24 hours or more after a meal on an infected animal. The trypanosomes in the gut are active from a minute to an hour after a meal, while 24 hours afterwards they are partially disintegrated, the cytoplasm becoming more granular and the flagellum disappearing. When parasites were not found in the peripheral blood, transmission could not be effected.

WALTON (C. L.). **Some Observations on the Fluctuations of certain injurious Species.**—*North Western Naturalist*, iii, nos. 2 & 3, pp. 77–80, 124–127, 26 refs. Arbroath, June & September 1928.

Ixodes ricinus, L., is very abundant on the rough lands of North Wales, and is the vector of bovine piroplasmosis.

Severe and widespread outbreaks of sheep maggot flies (*Lucilia* spp.) occur amongst sheep in West Wales, particularly in sheltered localities amongst trees during hot periods following rain or damp conditions. Bare, wind-swept and high regions are usually free from the flies. Where they do occur in such localities, it is suggested that if the rabbits, which are very numerous, were destroyed, the flies would die out. A table covering the period 1920–26 is given to show the correlation between the abundance of larvae of *Hypoderma lineatum*, Vill., and *H. bovis*, DeG., and the rainfall of the months April-July of the preceding year. Low infestations in 1921 and 1925 followed heavy rainfall.

[Miller (D.).] **Sheep Maggot-fly Parasite.**—*N. Z. J. Agric.*, xxxvii, no. 3, pp. 193–194, 2 refs. Wellington, 20th September 1928.

In order to avoid the difficulty experienced in the rearing of *Alysia manducator*, Panz., owing to the attacks of *Mormoniella vitripennis*, Wlk. (*Nasonia brevicornis*, Ashm.), meat containing blow-fly larvae exposed to the former was placed on earth about 1 ft. deep in the cages. The mature larvae burrowed deeply into this and were thus protected during the pupal stage from *M. vitripennis*. By this means the parasite was bred in abundance, and field liberations were made during the first three months of 1928.

The Buffalo Fly Pest.—*J. Council Sci. Ind. Res.*, i, no. 5, pp. 289–291. Melbourne, August 1928.

The possibilities of introducing *Hydrotaea dentipes*, F., as a control for *Lyperosia* sp. (buffalo-fly) in Australia, are not very promising, but a study is being made in Java with a view to discovering the parasites of this pest there. As a result, three species of Ichneumonids have been obtained, and a fourth was observed. One of these is a very small species that lays many eggs in one pupa ; the other three species, of which one is considerably more important than all the rest, deposit only one egg in each pupa, require about three weeks for development, and live about one month altogether. The method of rearing these is described, and it is hoped to make an attempt to introduce at least the most promising species. It is possible that parasites may also be found in Timor, whence the fly is believed to have originated, and these may prove better adapted to the Australian climate.

Wallace (D. H.). **Some Aspects of House Fly Control. The Viability of the newly "hatched" Fly under adverse Conditions.**—*Hlth. Bull. Dept. Publ. Hlth. Victoria*, no. 11, pp. 338–341. Melbourne, 1927.

Experiments are described that show that adults of the house-fly, *Musca domestica*, L., can emerge through 6–7 inches of sandy soil when larvae in horse dung or pupae are buried at that depth. Adults failed to emerge when larvae of *M. pumila*, Macq. (*vetustissima*, Wlk.) in cow dung were buried under the same conditions, although adults of this species emerged from unburied dung. Horse dung produced

exclusively *M. domestica* and cow dung exclusively *M. pumila*. In one experiment, about 1,000 pupae of *M. domestica* were buried at a depth of 7 inches in very sandy soil; adults emerged from 12 per cent. of these in from 1 to 18 days, the average daily minimum temperatures during the period being 47° F. Several newly emerged flies remained alive without food for 4 days in a glass bottle, surviving minimum night temperatures of 40° F.

These experiments indicate that the burial of manure in the soil cannot be relied upon to destroy the fly larvae and pupae that it contains.

Masci-Petriccioni (E.). **Yoghourth e** *Piophila casei*. [Sour Milk and *P. casei*.]—*Ann. Igiene*, xxxviii, no. 8, pp. 648–650, 3 refs. Rome, August 1928.

Observations made in Rome show that sour milk is very attractive to *Piophila casei*, L., and provides a very suitable medium for its development. As the eggs cannot hatch in the human intestine, the presence of larvae in faeces points to their ingestion unnoticed. Sour milk should not be sold except in sealed containers.

Filippini (A.). **Le mosche.—Danni e mezzi di difesa.**—*Ann. Igiene*, xxxviii, no. 8, pp. 651–683, 11 figs., 37 refs. Rome, August 1928.

This is a general survey of existing knowledge regarding flies, the part they play as carriers of disease, and the various methods of combating them.

Villeneuve (J.). **Quelques mots sur les Calliphorinae paléarctiques.**—*Bull. Ann. Soc. ent. Belg.*, lxviii, no. 8, pp. 147–151. Brussels, 30th September 1928.

Synonymic notes are given on a number of Palaearctic Calliphorids, including *Phormia terrae-novae*, R.-D. (*groenlandica*, Zett.) and *Calliphora uralensis*, Villen. (*pseuderythrocephala*, Kramer), and a new species is described.

Hutson (J. C.). **Report of the Entomological Division.**—*Reps. Insect Pests Ceylon 1927*, p. 1–8 [in] *Tech. Reps. 1927 Dept. Agric. Ceylon*. Colombo, 1928.

Experiments were carried out in 1927 by F. P. Jepson and M. P. D. Pinto to discover the breeding medium of *Siphunculina funicola*, de Meij. (eye-fly) in the open and to ascertain whether it could be controlled under natural conditions. Though a great deal of information was obtained, the breeding grounds could not be located. The entire development was observed in the laboratory, using moistened blood-meal as a breeding medium. The eggs hatched in 3 days, the larval stage lasted 6 days and the pupal stage 7. The flies lived for nearly 6 weeks in captivity. The generations appear to follow each other in

19 days in the open, and in the laboratory 4 generations were bred in 80 days. The flies were also successfully bred in a few decomposing animal and vegetable materials. No stage of the fly was found on growing plants, and it is suggested that the natural breeding medium is probably decomposing organic matter rather than some living plant as is usual for Oscinid flies.

Though it is generally considered that definite "eye-fly seasons" occur, coinciding with the dry weather, the flies are probably present throughout the year.

HÉRIVAUX (—). **Un foyer épidémique de trypanosomiase humaine au Togo.**—*Ann. Méd. Pharm. col.*, xxvi, no. 2, pp. 127–141, 14 refs. Paris, 1928.

An account is given of a serious outbreak of sleeping-sickness in the Lama-Tessi district in the northern part of French Togoland, discovered in January 1927. The area affected is in a high state of cultivation, there is no bush and game is almost or entirely absent. *Glossina palpalis*, R.-D., occurs along the river banks, but not in large numbers. In Togoland, as in other parts of West Africa, sleeping-sickness has hitherto been known only as a mild endemic disease.

MCCALL (F. J.). **Glossinae and Trypanosomiasis.**—*Rep. Dept. Vet. Sci. & Anim. Husb. Tanganyika Territory 1927*, pp. 7–12. London, 1928.

The general position with regard to trypanosomiasis of cattle remains unaltered, and reports from all districts continue to give evidence of the immensity and complexity of the problem. The small population of the Territory relative to its area, and migrations of people, even from districts free from tsetse-flies, for economic and other reasons, make it doubtful whether coercive measures to combat the situation are justified in many areas. Compulsory clearing to control *Glossina* is only considered to be justified when there is a real need for land, when sleeping-sickness endangers the community or when a corridor for communications is essential. Many cattle districts are so surrounded by tsetse-fly belts that the movement of cattle is very dangerous.

Reports from the districts adjacent to the Kenya border indicate that *Glossina swynnertoni*, Aust., does not extend north of the Mara river, which runs into Lake Victoria, or east of the Sanya river area, which also forms the western boundary of a belt infested with *G. pallidipes*, Aust. Other tsetse-flies recorded from these districts are *G. brevipalpis*, Newst., *G. palpalis*, R.-D. (var. *fuscipes*, Newst.) and *G. longipennis*, Corti.

PAPERS NOTICED BY TITLE ONLY.

SENEVET (G.). *Hyalomma mauritanicum* et *Hyalomma lusitanicum*.—*Arch. Inst. Pasteur Algérie*, vi, no. 1, pp. 35–41, 3 figs., 4 refs. Algiers, March 1928.

SENEVET (G.). **Bibliographie algérienne des travaux de microbiologie et de parasitologie parus en 1926 et 1927.**—*Arch. Inst. Pasteur Algérie*, vi, no. 1, pp. 99–108. Algiers, March 1928.

[Pavlovskiĭ] Pawlowsky (E. N.) & Stein (A. K.). **Ueber die Wirkung des Stiches von** *Ornithodoros papillipes* **Bir. auf den Menschen.** [On the Effect of the Bite of *Ornithodorus papillipes* on Man.]—*Abh. Gebiete Auslandsk. Hamburg. Univ.*, xxvi, Ser. D. Med. ii (Festschrift Nocht), pp. 401–408, 2 pls., 22 refs. Hamburg [1927]. [See also *R.A.E.*, B, xvi, 184.]

[Pavlovskiĭ (E. N.), Stein (A. K.) & Perfil'ev (P. P.).] **Павловский (Е. Н.), Штейн (А. К.) и Перфильев (П. П.). Experimental Investigations on the Effect of the active Elements of** *Culex pipiens* **on the Human Skin.** [*In Russian.*]—*C.R. Acad. Sci. U.R.S.S.*, 1928, no. 13, pp. 251–254, 1 ref. Leningrad, 1928. [*Cf. R.A.E.*, B, xiv, 19.]

[Dolbeshkin (B. I.).] **Долбешкин (Б. И.). On the Occurrence of** *Aëdes esoensis*, **Yam. (Diptera, Culicidae), in Orenburg.** [*In Russian.*]—*C.R. Acad. Sci. U.R.S.S.*, 1928, no. 13, pp. 227–228, 5 figs. Leningrad, 1928.

Swellengrebel (N. H.), de Buck (A.) & Schoute (E.). **On Anophelism** [*Anopheles maculipennis*] **without Malaria in the Vicinity of Amsterdam (2nd Communication).**—*Proc. Kon. Akad. Wetensch. Amst.*, xxxi, no. 4–5, pp. 531–539, 5 maps. Amsterdam, 1928. [See *R.A.E.*, B, xvi, 242.]

Bau (A.). **Die Gattung** *Cephenomyia*, **Latreille** [with Key] **(Diptera, olim Oestridae).**—*Centralbl. Bakt.*, (2) lxxv, no. 15–14, pp. 458–459. Jena, 12th September 1928.

Jobling (B.). **The Structure of the Head and Mouth-parts in the Nycteribiidae (Diptera Pupipara).**—*Parasitology*, xx, no. 3, pp. 254–272, 3 pls., 4 figs., 10 refs. Cambridge, October 1928.

Edwards (F. W.). **Diptera Nematocera from the Mountains of Borneo.** [Including one new *Culicoides* and one new Mosquito.]—*Sarawak Mus. J.*, iii, no. 10, pp. 243–278, 2 pls. Kuching, December 1926.

Ferris (G. F.). **Report upon a Collection of Hippoboscidae (Diptera Pupipara) from Borneo.**—*Sarawak Mus. J.*, iii, no. 10, pp. 279–286, 1 pl., 2 figs. Kuching, December 1926.

Jordan (K.) & Rothschild (N. C.). **Siphonaptera from Borneo.**—*Sarawak Mus. J.*, iii, no. 10, pp. 287–292, 7 figs. Kuching, December 1926.

Schuurmans Stekhoven (J. H.). **The Bloodsucking Arthropods of the Dutch East Indian Archipelago. IX. Recent Collections of Tabanids from Sumatra, Middle East Borneo, Soemba, etc.** [including three new Species].—*Zool. Jahrb.*, Abt. Syst., liv, no. 5–6, pp. 425–448, 5 figs. Jena, 1928.

Oudemans (A. C.). **Fauna Buruana. Acari.**—*Treubia*, vii, suppl., pt. 2, pp. 37–100, 175 figs. Buitenzorg, November 1928.

Pinto (C.). **Sobre a presença do** *Cimex foedus* **(Stål, 1854) no Brasil.** [Detailed Description; no Host; Occurrence in Brazil and Colombia.]—*Bol. biol.*, 1928, no. 13, pp. 85–91, 7 figs. S.Paulo, 22nd September 1928.

BLATCHLEY (W. S.). **The Mexican Chicken Bug in Florida.**—*Florida Ent.*, xii, no. 3, pp. 43–44, 3 refs. Gainesville, Fla., September 1928.

Haematosiphon inodorus, Dug., which is a serious pest of poultry in southern New Mexico, is recorded from Florida. Though occurring in various localities, it does not appear to be common anywhere. The characters differentiating it from *Cimex lectularius*, L., are briefly described.

BRUCE (W. G.). **The Use of Volck against external Parasites of domestic Animals.**—*J. Kansas Ent. Soc.*, i, no. 4, pp. 74–79. McPherson, Kans., October 1928.

The killing value of volck, a highly refined white oil, which was prepared with a special emulsifier to eliminate any possible irritating effect, was tested against certain insects and mites infesting domestic animals. No harm was done to animals when permitted to drink the oil.

The large hen louse, *Goniocotes gigas*, Tasch. (*abdominalis*, Piag.), the body louse, *Eomenacanthus stramineus*, Nitz. (*Menopon biseriatum*, Piag.), and the shaft louse, *Menopon gallinae*, L. (*pallidum*, Nitz.), were destroyed by immersing fowls in a 7 per cent. solution, which was rubbed into the feathers with the fingers. Two birds harbouring the tropical fowl mite, *Liponyssus bursa*, Berl., were similarly treated with an 8 per cent. solution, and all the mites were killed. Solutions of 50 and 60 per cent. volck were applied as a spray under great pressure to four poultry houses infested with *Dermanyssus gallinae*, DeG., all roosts being loosened and refuse removed before spraying. With heavy infestations the spray was repeated after 10 days. No live mites were found after treatment. A 10 per cent. solution as a dip or spray was effective against *Ctenocephalus canis*, Curt., and *C. felis*, Bch., on dogs and cats. An 8 per cent. spray gave satisfactory results against *Haematopinus suis*, L., on pigs and the biting louse, *Trichodectes scalaris*, Nitz., on cattle, as did a 10 per cent. mixture against the long-nosed ox louse, *Linognathus vituli*, L. A special spray disk that afforded deeper penetration and greater concentration of the liquid was used. An 8 per cent. solution of ordinary volck and a 10 per cent. one of the special emulsion killed all the lice, *Trichodectes parumpilosus*, Piag., and *Haematopinus asini*, L., on donkeys; the latter were thoroughly sprayed and the liquid worked into the hair. Undiluted volck applied with a rag proved satisfactory against the eggs of *Oestrus* (*Gastrophilus*) *intestinalis*, DeG., on the legs of horses. A 10 per cent. solution gave fairly good results as a head wash against *Pediculus capitis*, DeG. About 1 cc. of 50 per cent. volck was injected into the cyst of the ox-warble fly [*Hypoderma*], but no effect on the larva was noticed.

JOYEUX (C.) & BAER (J. G.). **Recherches sur le cycle évolutif d'*Hymenolepis fraterna*, Stiles.**—*C. R. Soc. Biol.*, xcix, no. 30, pp. 1317–1318. Paris, 2nd November 1928.

It is known that the Cestode, *Hymenolepis fraterna*, which is common in small rodents, develops without any intermediate host. Recently, in Buenos Aires, a rat Cestode, *H. bacigalupoi*, has been found to have as intermediate hosts the beetles, *Tenebrio molitor*, L., and *T. obscurus*,

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F., and the moth, *Pyralis farinalis*, L. *H. nana*, a Cestode of man, has been proved to be capable of development both in *T. molitor* and in the rat [*R.A.E.*, B, xvi, 230]. *H. fraterna* has also been transmitted to *T. molitor* and *T. obscurus*, and perhaps once to the flea, *Xenopsylla cheopis*, Roths., and recently Bacigalupo has obtained direct transmission from rat to rat. It is therefore considered that *H. bacigalupoi* and *H. fraterna* are identical.

In Paris it has been found that the presence of one or two Cestodes is enough to confer immunity on rats. The infection of insects is much more difficult. Coleoptera are only infected in the adult stage, either by this or by other Cestodes, such as *H. diminuta* and *H. microstoma*, which also develop in these species of *Tenebrio*. The cysticercoids were fully formed within 18 days, sometimes less. The authors' experimental attempts to infect fleas proved negative, nor have they ever observed natural infection with *H. fraterna* in either *Tenebrio* or any other insect, although numbers have been dissected. It would seem, therefore, that direct development of *H. fraterna* is the most usual in France, intermediate hosts proving difficult to infect.

DA COSTA LIMA (A.). *Nyssorhynchus bachmanni* (**Petrocchi, 1925**).—*C.R. Soc. Biol.*, xcix, no. 30, pp. 1349–1350. Paris, 2nd November 1928.

Anopheles (*Nyssorhynchus*) *bachmanni*, Petrocchi, which has been taken in Argentina, Paraguay, Venezuela and Brazil, is evidently a widespread species. The author is almost convinced that it also occurs in Dutch Guiana, as the figure of the genitalia of *A. tarsimaculatus*, Goeldi, given by Bonne [*R.A.E.*, B, xiv, 59] corresponds exactly with the appearance of those of *A. bachmanni*. The larva of the latter has not yet been described. Its distinguishing characters are discussed.

GEOGHEGAN (A. J.). **Deux nouveaux cas de trypanosomiase américaine humaine dans la province de Catamarca.**—*C. R. Soc. Biol.*, xcix, no. 31, pp. 1417–1418. Paris, 9th November 1928.

Two cases of American trypanosomiasis are recorded from Catamarca, northern Argentina. The disease is evidently more widespread in this area than was previously believed, as 70 per cent. of the individuals of *Triatoma infestans*, Klug, examined contained flagellates in the gut, and 40 per cent. of these contained metacyclic trypanosomes. The need for further and more detailed observations on the disease in this region is pointed out.

CARRIÓN (A. L.). **Preliminary Report on a Rat-Flea Survey of the City of San Juan, Porto Rico. Second Paper.**—*Porto Rico Rev. Publ. Hlth. Trop. Med.*, iv, no. 2, pp. 84–92, 7 charts. San Juan, P.R., August 1928.

In a second year's survey [*cf. R.A.E.*, B, xvi, 163], covering the period July 1927–June 1928, 53 per cent. of the living rats captured in San Juan, most of which were *Mus norvegicus*, harboured fleas. Of the 2,600 fleas identified, 99·5 per cent. were *Xenopsylla cheopis*, Roths., and other species found included *Echidnophaga gallinacea*, Westw., *Ctenocephalus canis*, Curt., or *C. felis*, Bch., *Pulex irritans*, L., and *Leptopsylla segnis*, Schönh. (*musculi*, Dug.). The insects were more

numerous about the docks and commercial section of the city, while seasonal variations in their incidence followed the relative humidity curve, temperature changes having apparently little influence. *Mus rattus alexandrinus* showed the highest degree of infestation for the year.

WENYON (C. M.). **Kala-azar and Oriental Sore: the Problem of Transmission.**—*Brit. Med. J.*, no. 3534, pp. 558–562. London, 29th September 1928.

Although there is very good circumstantial evidence that sandflies (*Phlebotomus*) are the vectors of kala-azar and oriental sore, the final proof of experimental transmission has not yet been obtained. If the contents of an infected sandfly are injected with a syringe into a suitable animal in the case of kala-azar, or into man in the case of oriental sore, infection readily occurs, but neither experimental animals nor man contract the disease when exposed to bites by even large numbers of heavily infected sandflies. Isolated observations indicate that the passing of the parasite from man to man is a possibility, but it is impossible that this should be the normal method of transmission.

So important, in the author's opinion, is the flagellate stage, which occurs in cultures and in insects, and so characteristic is it of an insect flagellate, that there appear to be overwhelming reasons for believing that the parasite known as the Leishman-Donovan body must have an invertebrate host. The fact that this body can develop into a flagellate in the stomach of an insect, is not proof that such an insect is the host. Although flagellates develop in bed-bugs (*Cimex*) fed on kala-azar cases, there is good reason for believing that the bug is not the vector, and that the development of flagellates occurs merely because its stomach contains a quantity of blood. Fleas and other blood-sucking Arthropods have also been shown not to be carriers of the parasite.

The development of the parasites of kala-azar and oriental sore in sandflies is progressive. In the bed-bug, there is only slight multiplication, but in the sandfly a relatively small number of organisms ingested leads to a heavy infection of the stomach. In the sandfly, infected by feeding on a case of kala-azar or oriental sore, there is no infection of the hind-gut, as is usual in insect Herpetomonads, but the stomach infection may extend forward into the oesophagus and buccal cavity. It is possible that this type of development is to be explained on the assumption that the sandfly is not the original host of the parasite, but becomes infected from man, who, in the first place, acquired the parasites from some other insect. This would indicate that if the original hypothetical insect host still exists, the virus would be able to maintain itself by direct passage from insect to insect, without necessarily infecting man. If sandflies are the actual vectors of kala-azar and oriental sore, the parasites may enter the wound made by the bite during the act of feeding, or, since occasional flagellates may be found in the hind-gut of the flies, as a result of having been washed there accidentally from the stomach, a very small number of flagellates might escape in the drops of fluid ejected from the rectum while feeding, and be rubbed into the skin, or carried on the fingers to the mouth, etc. The crushing of an infected sandfly on the skin might give rise to infection with oriental sore, but there is no evidence that the injection into the skin of organisms from an infected sandfly will produce kala-azar, though it is possible that it might do so.

The author discusses the distribution of the species of *Phlebotomus* in connection with that of kala-azar in India and China and of oriental sore in various parts of the world. He considers that the parasites causing these diseases in dogs are probably identical with those infecting man.

HINDLE (E.). **Further Observations on Chinese Kala Azar.**—*Proc. R. Soc.*, Ser. B. ciii, no. B.727, pp. 599–619, 2 pls., 5 refs. London, 1st November 1928.

The observations described were carried out in 1927. *Phlebotomus chinensis*, Newst., proved to be the most favourable species for the development of *Leishmania* [*cf. R.A.E.*, B, xvi, 20]. The flagellates become attached to the lining of the mid-gut and grow forward until they reach the anterior part of the gut. Invasion of the pharynx usually takes 6 days, and under favourable conditions about 25 per cent. of the flies show a proboscis infection. *P. sergenti*, Parrot, is an equally favourable host for the early development of the parasite, but in this species it remains confined to the broad posterior regions of the mid-gut, does not become attached to the lining of the gut, and never invades the proboscis. The infection is dependent on the presence of undigested food material and soon disappears when the gut is empty.

Out of 14 patients infected with kala-azar only 4 were infective to sandflies, and of these only about 5 per cent. showed any subsequent development of flagellates. It is therefore evident that the Chinese strain of *Leishmania* [*donovani*] is less infective to *Phlebotomus* than the Indian strain. The difference appears to be correlated with a lower degree of virulence. In human beings the Chinese strain produces a more chronic type of the disease than the Indian one.

Owing to the large number of negative results obtained in these experiments, special attention was directed towards the influence, if any, of the nature of the infection in the vertebrate host. The results of these experiments with *P. chinensis* and *P. sergenti* are summarised in a table that gives the size of the spleen of each hamster [*Cricetulus*], the number of parasites in the liver, spleen and bone marrow respectively, and the duration of infection from the date of inoculation to the date of the first feeding experiment. The results of experiments with one hamster are given in detail, owing to the high degree of infectivity obtained in the sandflies fed on it. Of 100 examples of *P. chinensis* fed on this animal all, with one or two doubtful exceptions, showed a heavy infection with flagellates in the mid-gut. In every case the flagellates had reached the anterior end of the mid-gut, and about 25 per cent. of the individuals dissected 6 days or more after the infective feed showed flagellates in the pharynx and proboscis. A typical infection with *Leishmania* was produced by intraperitoneal inoculation of the contents of four infected sandflies. In the case of *P. sergenti*, 50 out of 72 flies fed on this hamster showed flagellates in the mid-gut, and in 2 instances infections were produced in hamsters by the intraperitoneal inoculation of the contents of infected individuals.

The certainty with which the sandflies became infected when fed on this particular hamster was so remarkable that a careful examination was made of the animal. No correlation could be found between the presence of parasites in the blood and the development of flagellates in the sandflies. The blood films were negative on three occasions when

all sandflies became infected, while on other occasions the number of parasites in the blood was much too small to account for the development of such large numbers of flagellates in the flies after only three days. The subdermal layer of the animal, however, contained extraordinary large numbers of *Leishmania*, in certain regions the infection being so intense as to produce nodules closely resembling those of oriental sore. It is evident that in feeding the proboscis of the sandfly must pierce some of these cells and the parasites be ingested. Other hamsters were also examined ; the results clearly indicate the existence of a correlation between the presence of *Leishmania* in the skin and the number of sandflies that become infected. No matter how intense the infection of the internal viscera, unless parasites were present in the skin, insects fed on such hamsters remained uninfected.

Both *P. chinensis* and *P. sergenti*, infected with flagellates, gave negative results when fed on normal hamsters, and also when their contents were inoculated into the skin of the animals.

Wollman (E.), Anderson (C.) & Colas-Belcour (J.). **Recherches sur la conservation des virus hémophiles chez les insectes.**—*Arch. Inst. Pasteur Tunis*, xvii, no. 3, pp. 229–232, 3 refs. Tunis, September 1928.

Experiments are described that show the rapid disappearance of *Leishmania tropica* from house-flies [*Musca domestica*, L.] and of spirochaetes [*Spirochaeta duttoni* (*crocidurae*) and *S. hispanica*] from *Lucilia caesar*, L., and cockroaches [*cf. R.A.E.*, B, xvi, 103]. In *Stomoxys calcitrans*, L., however, *Spirochaeta duttoni* remained infective for rats, both by bites and by inoculation of the flies, for 48 hours after they had fed on infected rats, although negative results were obtained after three days. The authors consider that these results may indicate that the only insects in which blood parasites can survive are blood-sucking ones.

Shortt (H. E.), Craighead (A. C.), Smith (R. O. A.) & Swaminath (C. S.). **Further Transmission Experiments in Kala-azar with *Phlebotomus argentipes*.**—*Ind. J. Med. Res.*, xvi, no. 2, pp. 263–270, 4 refs. Calcutta, October 1928.

In continuation of previous unsuccessful attempts [*R.A.E.*, B, xv, 116] to transmit kala-azar to experimental animals by the bites of *Phlebotomus argentipes*, Ann. & Brun., experiments were made in which the dosage of infective material (in the form of sandflies infected with *Leishmania donovani*) was increased by exposing a comparatively small number of animals (mice and Chinese hamsters [*Cricetulus*]) to the bites of large numbers of infective midges. The same principle was applied as far as possible to four human volunteers. Negative results were obtained in all cases, in spite of the fact that the intensity of exposure to infection was very much greater than could ever obtain in nature. The results are not considered conclusive, however, since other workers have shown that hamsters inoculated by the subcutaneous, as opposed to the intraperitoneal route, are relatively insusceptible [*R.A.E.*, B, xiv, 222], and, in the case of the volunteers, where the degree of susceptibility and the limits of the incubation period of kala-azar are not really known, the number of experiments was too small to justify any conclusions.

SINTON (J. A.). **The Synonymy of the Asiatic Species of** *Phlebotomus*. —*Ind. J. Med. Res.*, xvi, no. 2, pp. 297–324, 8 refs. Calcutta, October 1928.

Since it has been shown that the buccal armature and spermathecae may show characteristic specific differences, applicable to female specimens of *Phlebotomus* [*R.A.E.*, B, xiv, 96], it has been possible, from a re-examination of the type specimens along these lines, to establish the synonymy of many Asiatic species. The author has found that Newstead's division of this genus into erect and recumbent-haired species is related to certain very definite morphological characters in the internal anatomy of the insects, and he therefore classifies the genus according to these characters and does not accept the subgenera of França and Parrot [*R.A.E.*, B, x, 50], though he points out that at present Newstead's divisions can only be applied to the Old World species.

The male of *Phlebotomus chalami*, Young & Chalam [*R.A.E.*, B, xv, 205] is the hitherto unknown male of *P. zeylanicus*, Ann., it being now recognised that the supposed male of *P. zeylanicus*, as originally described, is the male of *P. argentipes*, Ann. & Brun. Brunetti's view that *P. perniciosus*, Newst., is a variety of *P. major*, Ann., is confirmed. *P. chinensis*, Newst., of which *P. major* var. *longiductus*, Parrot [*R.A.E.* B, xvii, 17] is a synonym, is considered to be specifically distinct from *P. major*. Newstead's view that *P. caucasicus*, Marz., is a synonym of *P. sergenti*, Parrot [*R.A.E.*, B, ix, 43] is confirmed. *P. sergenti* var. *alexandri*, n., and *P. sergenti* var. *mongolensis*, n., are described, the latter being the *Phlebotomus* "C" of Young and Hertig [*R.A.E.*, B, xv, 177]. *P. li* is considered specifically distinct from *P. sergenti* [*cf. R.A.E.*, B, xvi, 201; xvii, 17]. *P. hospitii*, Sinton, is considered specifically distinct from *P. similimus*, Newst. [*cf. R.A.E.*, B, xiii, 14]. *P. minutus* var. *niger* of Adler and Theodor in Palestine shows the characteristics of *P. minutus*, Rond., and must therefore be considered a melanic variety of that species and not of *P. babu*, Ann. *P. perturbans* var. [*R.A.E.*, B, xv, 41], afterwards named *P. taianensis*, Patt. & Hindle [*R.A.E.*, B, xvi, 168], is considered synonymous with *P. squamirostris*, Newst., which is also *Phlebotomus* "B" of Young & Hertig [*R.A.E.*, B, xv, 177]. *P. sylvestris*, Sinton, is the species recorded by Annandale as *P. perturbans*, de Meij. A revised list of the Asiatic species of *Phlebotomus* is given.

SINTON (J. A.) & BARRAUD (P. J.). **Improved Methods for the Identification of some Species of** *Phlebotomus* **used in Experimental Work.** —*Ind. J. Med. Res.*, xvi, no. 2, pp. 325–331, 2 pls., 9 refs. Calcutta, October 1928.

So far as is known at present the only species of *Phlebotomus* that transmit disease to man belong to the erect-haired group, the common species used in experimental work being *P. papatasii*, Scop., *P. sergenti*, Parrot, *P. sergenti* var. of Patton & Hindle, *P. argentipes*, Ann., *P. major*, Ann., *P. major* var. *perniciosus*, Newst., and *P. chinensis*, Newst. Since it is necessary in work on the transmission of disease that the insect should be accurately identified, a simple method of identifying the females is described. The diagnostic characters of the spermathecae and pharynx are discussed, and the distinguishing points are given for each of the above-mentioned species. Two keys based on

the morphology of the spermathecae and on the appearance of the armature of the dorsal plate of the pharynx are also given. The method described may be applied to freshly killed specimens, and when a supply of clean, unfed insects is required, females that have been confined in separate test tubes until oviposition occurs may be identified and the eggs transferred to breeding pots containing eggs and larvae of the same species. The method does not interfere with the dissection of the alimentary tract for the investigation of parasitic infections, and may be used for the identification of the females of this group captured in the field.

BARRAUD (P. J.). **The Distribution of "*Stegomyia fasciata*" in India, with Remarks on Dengue and Yellow Fever.** *Ind. J. Med. Res.*, xvi, no. 2, pp. 377–388, 2 maps, 4 pp. refs. Calcutta, October 1928.

Notes are given on the habits and races of *Aëdes* (*Stegomyia*) *argenteus*, Poir., its connection with yellow fever and dengue, and its distribution and control in India, most of the information being taken from the literature. Although the possibility appears remote, the author points out that should yellow fever be introduced into India, a dangerous reservoir of infection would probably be created in the monkeys, *Macacus rhesus* and *M. sinicus*, that have recently been found susceptible to the disease [*R.A.E.*, B, xvi, 180], more especially as the combined distribution of these animals covers practically the whole of India.

PURI (I. M.). **On two Species of Indian Anopheline Mosquitoes, *A. jeyporiensis*, James and *A. moghulensis*, Christophers.** *Ind. J. Med. Res.*, xvi, no. 2, pp. 513–518, 2 pls., 6 refs. Calcutta, October 1928.

A close study of the larvae as well as the adults of *Anopheles jeyporiensis*, James, and *A. jeyporiensis moghulensis*, Christ. [*R.A.E.*, B, xiii, 14] has shown that the latter is an independent species and belongs to the group *Neocellia*, whereas *A. jeyporiensis* belongs to the group *Myzomyia*. The differences between the adults are pointed out, and the full-grown larva of each species is described in detail.

PURI (I. M.). **The Relationship of certain Morphological Characters of Anopheline Larvae to the Classification of Indian Anopheline Mosquitoes.** *Ind. J. Med. Res.*, xvi, no. 2, pp. 519–528, 2 pls., 1 fldg. table, 7 refs. Calcutta, October 1928.

The following is taken from the author's summary:—The Indian species of *Anopheles* have been grouped for the first time on the morphological characters of the full-grown larvae, mainly by the pleural hairs on the ventro-lateral surface of the thorax. These characters are given in tabular form for the various divisions and groups. This grouping is shown to correspond more or less to the classification of Christophers, as based on the male genitalia and the general characters of the adult mosquito [*R.A.E.*, B, xiii, 109], and except in certain details to that determined by Barraud and Covell in their study of the buccopharyngeal armature [*R.A.E.*, B, xvi, 176]. The study of the pleural hairs may be useful in determining the relationship of species in which

the adults resemble each other very closely and can also be used in the field for differentiating the larvae of certain malaria carrying mosquitos from those of the commonest Indian Anopheline (*A. subpictus*, Grassi), which has not been proved a carrier in nature.

MAYNE (B.). **An Anopheline Mosquito as Host for the Parasite of Bird Malaria.**—*Ind. J. Med. Res.*, xvi, no. 2, pp. 557–558. Calcutta, October 1928.

The author points out that the finding of malarial parasites in an Anopheline mosquito is not necessarily a proof that the species is a carrier of human malaria, since he has obtained parasites of avian malaria (provisionally identified as *Plasmodium praecox*) from *Anopheles subpictus*, Grassi, captured in a room where several malaria-infected birds were kept for experimental purposes, and also from individuals bred in the laboratory and actually fed on an infected sparrow.

DULZETTO (F.). **Osservazioni sulla vita sessuale della "*Gambusia holbrooki*" (Grd.).** [Observations on the sexual Life of *G. holbrooki*.]—*Atti R. Accad. naz. Lincei*, (6) Rend. Cl. Sci. fis. mat. nat., viii, no. 1–2, pp. 96–101, 5 refs. Rome, 1928.

This paper describes observations made in Sicily on the reproductive capacity of females of *Gambusia holbrooki*, the top-minnow imported against mosquito larvae. As previously shown, there is only 1 male to 8–10 females, and a fertilised female can produce several generations of young in the course of a summer, without further pairing. Such females, kept without males through the winter in a tank out of doors at Catania, again produced young in the following spring. During the winter they remained in the mud at the bottom of the tank. Hitherto it has been assumed that the females cannot retain reproductive power through the winter.

ACHUNDOW (I.). **Die Modifikation der Anophelen unter den äusseren Bedingungen und kritische Betrachtungen der Rassenfrage.** [The Modification of Anophelines under external Conditions and critical Observations of the Question of Races.]—*Arch. Schiffs- u. Tropenhyg.*, xxxii, no. 11, pp. 547–561, 8 figs., 1 pl., 17 refs. Leipzig, November 1928.

As closely related species of *Anopheles*, such as *A. ludlowi*, Theo., and *A. subpictus*, Grassi (*rossi*, Giles), can be of very different importance as vectors of malaria, it is probable that subspecific and racial differences may also have a practical bearing on the subject. An outline is given of the views of various workers since Roubaud claimed the existence of a man-avoiding race of *Anopheles maculipennis*, Mg., occurring north of the Alps and attacking only cattle; and experiments are described that tend to confirm Martini's contention that differences in size and in the number of maxillary teeth are of doubtful value as evidences of the existence of an actual race [*R.A.E.*, B, x, 228]. Observations were made for over three months with many larvae of *A. maculipennis* and *A. bifurcatus*, L., and with a number of Culicines, including *Aëdes argenteus*, Poir. (*Stegomyia fasciata*, F.). Five large glass containers were used,

painted outside white, black, grey, green and brown. These, apparently small, external differences sufficed to produce, from the same batches of eggs, differences in the larvae, and, in the case of the Anophelines, in the adults also. In the case of *A. maculipennis* and *A. bifurcatus*, the white container produced white larvae, white and large pupae and light-coloured, large adults. The black and brown containers produced dark brown larvae, black and small pupae, and dark, small adults. Grey and green containers produced white and large pupae and light-coloured large adults; the larvae were whitish yellow with the grey container, and whitish green with the green one. In the case of *Aëdes argenteus*, the white and black containers each produced both black and white pupae. There was no difference in the adults, but larvae from the black container were slightly smaller than those from the white one. With other Culicines, there were no differences in the adults, but differences were observed in the larvae and pupae similar to those in the Anophelines. It is suggested that differences in the colour of adult Anophelines observed in nature may result from differences in the breeding-places of the larvae. The colour of the Anophelines from the black and brown containers was found to be due, not simply to a colouring of the chitin, but also to an accumulation of pigment in cells in the integument and fatty tissue.

HECHT (O.). **Ueber die Sprosspilze der Oesophagusausstülpungen und über die Giftwirkung der Speicheldrüsen von Stechmücken.** [On the Yeast-fungi from the oesophageal Dilatations and on the toxic Action of the Salivary Glands of Mosquitos. *Arch. Schiffs- u. Tropenhyg.*, xxxii, no. 11, pp. 561–575, 7 figs., 37 refs. Leipzig, November 1928; [abridged in] *Verh. deuts. zool. Ges.* (*Beih. Zool. Anz.*), iii, pp. 132–134. Leipzig, 1928.

The yeast-like fungi observed in mosquitos by various workers have been regarded as symbiotic. The author has tried to isolate and cultivate the yeast-fungi from mosquitos to determine whether they cause the reaction to the bites. He was never able to find such fungi in mosquitos taken direct from cellars and prepared without previous feeding on sugar-water. The species examined were *Anopheles maculipennis*, Mg., *Aëdes argenteus*, Poir. (*Stegomyia fasciata*, F.), *Culex pipiens*, L., and *Theobaldia annulata*, Schr., all being females. Individuals previously fed on yeast-containing materials always contained yeasts. The occurrence of yeasts in the oesophageal dilatations is therefore not symbiotic, but results from fungi that are occasionally ingested. The results of injecting various organs of mosquitos in a 0·75 per cent. salt solution show that no particular importance attaches to the contents of the crop and that the saliva alone is responsible for the irritation.

NARVIG (L. R.). *Anopheles maculipennis.*—*Norsk. ent. Tidsskr.*, ii, no. 5, p. 302. Oslo, 1928.

Large numbers of larvae of *Anopheles maculipennis*, Mg., were collected in almost all the localities visited in the course of an expedition in the neighbourhood of Oslo Fjord, where they occurred chiefly in old dykes. This mosquito is probably widely distributed in southern Norway.

LEPLAE (E.). **Malaria et culture de quinine au Congo Belge.**—*Bull. agric. Congo belge*, xix, no. 2, pp. 295–332, 9 figs. Brussels, June 1928.

The problem of combating malaria in the Belgian Congo is discussed at length, and since anti-mosquito measures would be economically impossible in the native villages scattered over vast areas, the author suggests that quinine could be made available to the indigenous population by cultivating cinchona in the Congo.

DE BEAUREPAIRE ARAGÃO (H.). **Report upon some Researches on Yellow Fever.**—*Suppl. Mem. Inst. Oswaldo Cruz*, no. 2, pp. 23–46, 9 figs. Rio de Janeiro, 15th October 1928. (In Portuguese and English.)

Recent cases of yellow fever in Rio de Janeiro offered an opportunity for experiments on *Macacus rhesus*, *M. cynomolgus* and *M. speciosus*, in which the disease developed in 5–15 days after inoculation or the bite of infected females of *Aëdes argenteus*, Poir. (*aegypti*, L.). The virus appeared identical in all respects with that occurring in Africa. The bite of one mosquito was sufficient to produce an infection that caused death. *Leptospira icteroides* was not found associated with yellow fever infection.

BOYD (M. F.) & FOOT (H.). **Studies on the Bionomics of American Anophelines. The Alimentation of Anopheline Larvae and its Relation to their Distribution in Nature.**—*J. Prevent. Med.*, ii, no. 3, pp. 219–242, 10 figs., 2 refs. Baltimore, Md., May 1928.

Investigations were carried out from July 1926 to June 1927 to determine whether the distribution of Anopheline larvae in different collections of water was controlled to any extent by the food material available.

The following is taken from the authors' summary and conclusions. The fourth stage larvae of *A. quadrimaculatus*, Say, and *A. punctipennis*, Say, appear to ingest the same plankton elements, including protozoa, green algae and diatoms, but no positive correlation was found to exist in nature between the distribution of the larvae and that of this plankton. When found alone, *A. quadrimaculatus* usually occurs in situations with a more varied plankton (ponds), and *A. punctipennis* in situations where it is least varied ; when found together, they occur in intermediate situations. It is concluded that the distribution of these two species is not controlled by nutritional factors and that other causes, perhaps of a thermal character, exercise an important influence.

HEARLE (E.). **Mosquito Control Activities in Western Canada.**—*58th Ann. Rep. Ent. Soc. Ontario 1927*, pp. 45–50. Toronto, 1928.

Since 1921 a detailed investigation of the mosquitos of the Rocky Mountain Park near Banff has been completed, and studies of the biology of the main prairie species have been carried out in Saskatchewan and Manitoba. The rapidly increasing tourist traffic is responsible for much

of the interest taken in mosquito control in Western Canada. Mosquitos are undoubtedly serious pests in live stock and dairy districts, severe attacks resulting in lessened milk production and poor condition of the cattle ; in 1927 these points were forcibly demonstrated by an abnormal number of mosquitos and excellent pasture conditions.

In the lower Fraser Valley more than half the flood water breeding areas have been reclaimed, and organised control has become much more feasible. In various districts in the interior of British Columbia, where the species concerned include *Aëdes hirsuteron*, Theo., *A. vexans*, Mg., *A. punctor*, Kby., *A. dorsalis*, Mg., and *A. cinereus*, Mg., control operations have met with considerable success, and instances of a marked improvement in the milk yield of cows has been recorded. The work has consisted of oiling and filling in marshy areas. Anophelines, especially *Anopheles maculipennis*, Mg., are more common in one area, a semi-arid valley, than anywhere else in British Columbia. During 1927 mosquitos were unusually numerous in the Kootenay valley, where an area of 100,000 acres is subject to flooding. About 30,000 acres have been reclaimed on the American side of the valley, and plans have been made for the reclamation of the area on the Canadian side.

In the Banff district in the Alberta Mountains there are three periods of mosquito breeding, in the snow pools in April and May, in the rain pools in late spring, and in the flood pools made by the freshets in June. Systematic oiling has been carried out in this district since 1922, and although this is difficult, owing to the nature of the country, almost perfect control has been obtained. The total expenditure has been very heavy, but the increasing number of tourists makes this worth while. The main species in this district are *A. cataphylla*, Dyar, *A. intrudens*, Dyar, and *A. vexans*. In a second district the problem was found to be far simpler ; there is no flood area, and most of the mosquitos develop from the pools formed by the melting snow. The species of major importance are *A. cataphylla*, *A. intrudens*, *A. punctor* and *A. pullatus*, Coq. No extensive systematic oiling programme has yet been undertaken in the Yukon Territory, but it is thought that the problem here could be readily dealt with as it appears to be a question of early snow-pool breeding.

In the Prairie Provinces, mosquitos were more numerous in 1927 than they had been for many years, owing to the abnormally wet season ; in the worst affected districts a reduction in the milk production was evident, and considering the excellent pasture conditions, live stock did not thrive as they should have done. The main sources of mosquitos in the irrigated sections of Montana and Alberta are the lucerne and blue-joint grass meadows ; the numbers in these meadows increase with each irrigation, the main species breeding in the pools being *A. dorsalis*, *A. nigromaculis*, Ludl., and *A. vexans*. A preliminary investigation of the mosquito situation at Winnipeg was started in 1927 ; the poor drainage of extensive areas of uncultivated land surrounding the city results in the accumulation of much water during wet seasons. Control operations were undertaken, and the results have been very encouraging. The important species in this district were *A. hirsuteron*, *A. dorsalis* and *A. canadensis*, Theo.

In the discussion that followed this paper, the author stated that *Gambusia affinis* had thrived well in warm sulphur pools (*R.A.E.*, B, xvi, 144), and large numbers were placed in the lakes, but that it had been impossible to find out whether the fish had acclimatised itself in the cold water.

KIRK (J. B.). **The Incidence of Filariasis in Port Louis, Mauritius.**—*Trans. R. Soc. Trop. Med. & Hyg.*, xxii, no. 3, pp. 263–268, 4 refs. London, November 1928.

In Port Louis, Mauritius, where the population is very careless with regard to general hygiene and the storage of domestic water, mosquito breeding is possible in the compounds throughout the year, the common species being *Anopheles gambiae*, Giles (*costalis*, Theo.), *Aëdes albopictus*, Skuse, *A. argenteus*, Poir., and *Culex fatigans*, Wied. Infection with *Filaria bancrofti* was found in 32 per cent. of hospital cases in 1925 and in 11·2 per cent. of some hundreds of the general public in 1927. The infection was generally more benign than in many other parts of the world. Among the children examined, none under five years of age was infected, and among adults, men were more generally infected than women. It remains to be determined whether *C. fatigans* is the sole vector.

CURSON (H. H.). **The probable Limits of *Glossina* sp. in Zululand.**—*Trans. R. Soc. Trop. Med. & Hyg.*, xxii, no. 3, pp. 281–284, 1 pl., 6 refs. London, November 1928.

Information on the distribution of *Glossina* in Zululand is very incomplete, but a recent survey has revealed that the fly country, instead of consisting of separate areas as hitherto believed, comprises one continuous tract extending southwards from Mozambique to the Ngoye Range in Mtunzini District. The probable boundaries of this area, largely dependent on the presence of bush, are discussed and shown in a map. The Zululand fly country is, in fact, merely an extension southwards of the larger regions of the north and comprises about 3,000 square miles, or about one-third of Zululand. The principal species is *G. pallidipes*, Aust. [*cf. R.A.E.*, B, xvi, 129].

ZAVATTARI (E.). **Le affinità morfologiche e biologiche fra Ippoboscidi e Glossine.** [Morphological and biological Similarities between Hippoboscids and *Glossina*.]—*Atti Soc. ital. Sci. nat.*, lxvii, pp. 37–70, 9 figs., 35 refs. Pavia, 1928.

The morphological characters, structure and biology of Hippoboscids and *Glossina* are compared. The similarities met with are considered so numerous and significant that *Glossina* appears to represent a stage intermediate between the non-parasitic Muscids and the Hippoboscids and to be closely allied to the latter.

DUKE (H. L.). **General Review of the Activities of the Commission.**—*Interim Rep. League of Nations Internat. Commiss. Human Trypanosomiasis*, pp. 7–15, 6 pls. Geneva, League of Nations Health Organisation (C.H. 536), March 1927.

This is a brief account of the work of the International Commission for the study of sleeping-sickness from January to December 1926, and includes the programmes of laboratory experiments and epidemiological studies.

KLEINE (F. K.). **Report on my Visit to the Kavirondo Coast.**—*Interim Rep. League of Nations Internat. Commiss. Human Trypanosomiasis*, pp. 17–22, 1 fig. Geneva, March 1927.

The author found that sleeping-sickness was not epidemic in South Kavirondo, on the shore of Lake Victoria, Kenya, where the disease is due to *Trypanosoma gambiense* carried by *Glossina palpalis*, R.-D. He considers that the reason for this is the small percentage of infected tsetse-flies rather than any immunity of the population.

DUKE (H. L.). **Experiments on the cyclical Transmission by *Glossina palpalis* of Arsenic-fast Strains of Polymorphic Trypanosomes.**—*Interim Rep. League of Nations Internat. Commiss. Human Trypanosomiasis*, pp. 23–33, 3 refs. Geneva, March 1927.

The experiments described were carried out on monkeys with laboratory-bred individuals of *Glossina palpalis*, R.-D., and the Damba trypanosome, isolated from a situtunga antelope [see below, p. 41]. The author concludes that the acquired character of resistance to arsenic persists after cyclical passage of the strain through *Glossina* ; and that the character survives, at any rate to the third cyclical passage. He points out that in view of the practical importance of these results it is essential that the experiments should be repeated with *Trypanosoma gambiense*.

DUKE (H. L.). **Experiments on the Value of Bayer 205 as a Prophylactic against Trypanosomes developing in *Glossina palpalis*.**—*Interim Rep. League of Nations Internat. Commiss. Human Trypanosomiasis*, pp. 35–39, 3 refs. Geneva, March 1927.

The conclusions from these experiments with laboratory-bred individuals of *Glossina palpalis*, R.-D., fed on monkeys that had been inoculated 48–408 hours previously with Bayer 205 and 24 hours later on monkeys infected with the Damba trypanosome or with *Trypanosoma gambiense*, are that cyclical development of trypanosomes in the fly is not inhibited by a preliminary feed on blood containing the drug. It also appeared that a dose of 0·023 gm. Bayer 205 per kgm. body weight in a monkey protects the animal against infection by cyclically infected flies for a period of not more than two months.

VAN HOOF (L.). **Epidemiological Enquiry into Sleeping-sickness in the Budama District and the Kavirondo Country.**—*Interim Rep. League of Nations Internat. Commiss. Human Trypanosomiasis*, pp. 41–103, 6 pls., 2 maps, 3 refs. Geneva, March 1927.

This is a detailed report on an investigation made from February to September 1926 in the Budama and neighbouring districts of Uganda and the adjoining part of the Kavirondo district in Kenya, north-east of Lake Victoria. Sleeping-sickness in these districts is caused by *Trypanosoma gambiense*, and the tsetse-fly is *Glossina palpalis*, R.-D. Notes are given on the topography, economic conditions, etc., with details of a large number of observations on cases of sleeping-sickness met with in the course of the examination of more than 45,000 natives.

In the Samia endemic zone along the shore of Lake Victoria, in both Uganda and Kenya, sleeping-sickness is found wherever the natives are in contact with *G. palpalis*, but the prevalence of the disease is not

necessarily proportionate to the number of tsetse-flies. The fishing industry is mainly responsible for maintaining the disease in an endemic state. *G. palpalis* is not abundant, but its breeding-places are concentrated in the spots most frequented by the natives. The possibility that mosquitos, which frequently occur in very large numbers in and around the native huts, may act as mechanical vectors of *T. gambiense* is discussed ; infection of persons in the same house is, however, exceptional, and when it does occur, can generally be traced in each case to visits to breeding-places of *G. palpalis*. Man is considered to be the only reservoir of the trypanosome as game is so rare that it can be excluded, and cattle are not kept in areas infested with *Glossina*.

The districts further from the Lake, to the north (Busitema, Budama, Bugweri and Busoga), became isolated from other infected areas after the great sleeping-sickness epidemic of 1900. Changes in the type of vegetation, particularly along the river banks, and in the industries of the natives, the growing of bananas along the rivers and, to a large extent, the abandonment of fishing, have resulted in a great reduction in the numbers of *G. palpalis* and in the contact between it and man. Such tsetse-flies as do occur seem to be largely dependent on game. These facts explain the decrease in the number of cases of sleeping-sickness, which are now very few, no recently infected case being found by the author except in Busitema. In addition, however, the pathogenicity of the trypanosome appears to have diminished, perhaps on account of isolation. The endemic zone in Busitema can be reduced to a few foci near breeding grounds of *G. palpalis*.

The following is taken from the author's general conclusions :—The continuance of the endemic is closely bound up with the existence of *G. palpalis*. The number of flies and the ratio between the sexes seem to have less importance than other factors, such as the occupations of the natives. The limit of security for the natives cannot be calculated on the basis of figures representing a minimum of contact between man and fly ; it consists in the complete separation of these hosts from the trypanosome. The history of the disease, as well as the author's detailed observations, shows that the spread of sleeping-sickness is favoured by all the circumstances (occupation, famine, migration, etc.), that have caused removals of population, and there is reason to believe that its virulence becomes weakened in an endemic area if no new elements (trypanosomes, flies or men) are introduced.

LAVIER (G.). **The Posterior-nuclear Form.**—*Interim Rep. League of Nations Internat. Commiss. Human Trypanosomiasis*, pp. 117–142, 26 figs., 25 refs. Geneva, March 1927.

This is a detailed discussion of the occurrence and origin of posterior displacement of the nucleus in *Trypanosoma gambiense* isolated from man in areas infested with *Glossina palpalis*, R.-D., near Lake Victoria, and inoculated into guineapigs. A briefer account has already been noticed [*R.A.E.*, B, xvi, 16].

LAVIER (G.). **On the Existence of *Trypanosoma vivax* in Man.**—*Interim Rep. League of Nations Internat. Commiss. Human Trypanosomiasis*, pp. 143–147, 2 figs., 1 ref. Geneva, March 1927.

The author records the occurrence in man in Uganda of a trypanosome that, when stained, was indistinguishable from *Trypanosoma*

vivax; in the natural state in the blood, however, it displayed the typical movements of *T. gambiense*, and it produced an infection clinically typical for the latter. When inoculated into a monkey and a rat, the trypanosome produced forms similar to *T. gambiense*. Laboratory-bred individuals of *Glossina palpalis*, R.-D., were fed on the patient, and infections of the gut and salivary glands developed in 16 of these, but no infections of the proboscis occurred. The author concludes that *T. gambiense* is capable of presenting itself in man with the appearance of *T. vivax*, which would explain the supposed discovery of the latter in man in the Gold Coast by Macfie [*R.A.E.*, B, vi, 17]. *T. vivax* must therefore be struck off the list of human parasites until it is recognised beyond question and its identity proved experimentally.

KLEINE (F. K.). **Report on the new Sleeping-sickness Focus at Ikoma.** —*Final Rep. League of Nations Internat. Commiss. Human Trypanosomiasis*, pp. 7–20, 1 pl. Geneva, League of Nations Health Organisation (C.H.629), 1928.

The focus of sleeping-sickness with which this paper deals is in the northern part of Tanganyika Territory, east of Lake Victoria; the parasite is *Trypanosoma rhodesiense* and the vector *Glossina swynnertoni*, Aust. The author's investigations, which included the study of the morphology of twelve strains of the trypanosome inoculated directly from man to guineapigs, lead him to conclude that *T. rhodesiense* is probably identical with *T. gambiense*, and that the origin of the outbreak at Ikoma and others in hitherto uninfected parts of the Territory can be ascribed to the immigration of infected natives from old foci on the shore of Lake Victoria and elsewhere.

The author briefly summarises the evidence in favour of *T. rhodesiense* in man being distinct from *T. brucei* in animals, and draws attention to the fact that transmission of *T. gambiense* by *G. morsitans*, Westw., and *G. swynnertoni* has been effected in a number of cases.

The author considers that in the subsidence of an epidemic of sleeping-sickness an important part is played by loss of virulence on the part of the trypanosomes, which occurs when the tsetse-flies feed on chronic cases, and may also be assumed to occur when the flies are compelled by decrease of population owing to death and migration to feed on animals. He does not believe that mechanical transmission of sleeping-sickness trypanosomes occurs. With regard to the control of sleeping-sickness in Ikoma, he suggests that the most effective method may prove to be treatment by means of drugs, which sterilise the blood for months so that tsetse-flies cannot become infected from the treated patients.

DUKE (H. L.). **Studies on the Bionomics of the Polymorphic Trypanosomes of Man and Ruminants.** —*Final Rep. League of Nations Internat. Commiss. Human Trypanosomiasis*, pp. 21–116, 1 map, 5 figs., 37 refs. Geneva, 1928.

This report consists of an introduction, in which the author briefly reviews the activities of the Commission and describes the method of indicating the degree of transmissibility of strains of trypanosomes and the technique employed in determining this, and a number of separate papers on different aspects of the problem of the polymorphic trypano-

somes investigated at the Entebbe laboratory. What the author terms the " transmissibility index " of a strain is the percentage of infected tsetse-flies that would have developed infections of the salivary glands if all had lived long enough. This figure is arrived at by multiplying the " metacyclic index," which is the proportion of infected flies that have lived 25 days (the time required in the development of an average strain for the invasion of the salivary glands) and upwards and show infections of the salivary glands, by the " infectivity index," which is the percentage of the total number of flies of all ages dissected during the experiment that contain flagellates either in the gut alone or in the gut and salivary glands.

The first paper gives an account of studies of 19 strains of *Trypanosoma gambiense* isolated from untreated natives in areas of *Glossina palpalis*, R.-D., the first part dealing with their cyclical transmissibility by *G. palpalis* when first isolated from man, and the second part with the behaviour of some of them in ruminants.

The following is taken from the author's summaries: It is clear from these experiments that on their first isolation from man, or actually in man himself, different strains of *T. gambiense* show great differences in cyclical transmissibility by *G. palpalis*. Of the 19 strains examined, 12 were studied in the human patient; of these 12 strains, 4 were non-transmissible cyclically by laboratory-bred *G. palpalis*. The transmissibility of a strain seems to bear no constant relation to its virulence in man. As a rule it is very difficult to determine the duration of an infection in a native, and consequently to determine to what extent prolonged sojourn in man affects the transmissibility of a trypanosome. It is possible that a low degree of transmissibility is associated with a much changed cerebro-spinal fluid, and this with an old-standing infection; but it seems likely that, at any stage of an infection of man by *T. gambiense*, the transmissibility of the trypanosome by *G. palpalis* may be lost. The experiments with ruminants indicate that, as a rule, the transmissibility of a strain of *T. gambiense* diminishes when it is introduced into a sheep or goat, and disappears after a few months; that a strain may lose its transmissibility quite suddenly on being transferred from one host to another by cyclically infected *G. palpalis*; and that it is improbable that sheep and goats play any important part as reservoirs of *T. gambiense*, while calves are negligible in this respect.

The first part of the second paper gives the results of experiments on the transmissibility by *G. palpalis* of four strains of *T. rhodesiense* isolated from man, three from the Mwanza-Ikoma area of Tanganyika Territory and one from the Belgian Congo (west of Lake Albert). These experiments and two previous ones with strains from Mwanza indicate that *T. rhodesiense* is better adapted to cyclical development even in *G. palpalis* than is *T. gambiense*, while its pathogenicity for sheep, goats and calves is remarkable, several animals that had proved resistant to *T. gambiense* succumbing rapidly when bitten by individuals of *G. palpalis* cyclically infected with *T. rhodesiense*. In the second part of this paper, the author discusses the relation between *T. gambiense*, *T. rhodesiense* and *T. brucei*. His view is that *T. brucei* and *T. rhodesiense* are the same species, *T. rhodesiense* being the name given to strains that can utilise man as a host, which most of the strains of *T. brucei* cannot do; and that *T. rhodesiense* can be found wherever game-tsetse (*G. morsitans*, Westw., and its allies) are in close biological contact with man. The essential point of this view is that the selection is exercised by the trypanosome rather than by the mammalian host.

In the light of this theory, the failure of attempts to infect man with *T. brucei* becomes less significant, as only some ten strains have been tested in this way. Recent experience has led the author to modify his views on the importance of direct transmission in the spread of *T. rhodesiense* and the stabilising effect of cyclical passages through the fly [*R.A.E.*, B, xi, 190 ; xiii, 41]. He considers that the differences between *T. gambiense* and *T. rhodesiense* are due to the habits and species of *Glossina* and the nature of the principal mammalian hosts, man or game.

The third paper gives details of experiments on the transmissibility, by laboratory-bred individuals of *G. palpalis*, of certain strains of polymorphic trypanosomes from domestic and wild animals. The results suggest that the game trypanosomes from *G. palpalis* areas have a low transmissibility index—even lower than that of strains from game-tsetse areas.

The fourth paper gives the results of experiments on the effect of direct transmission (by inoculation) on a polymorphic trypanosome isolated from the blood of a situtunga antelope on Damba Island in Lake Victoria (Uganda) in 1924. Loss of transmissibility by *Glossina palpalis* occurred between the thirtieth and thirty-second passages in monkeys. At the thirtieth passage the strain was transmitted to several monkeys by cyclically infected individuals of *G. palpalis*, but this apparently had no revivifying effect on the trypanosome, as only 2 out of 123 flies fed on one of the cyclically infected monkeys became infected, and in these the infection did not reach the glands.

The fifth paper is devoted to a discussion of the transmissibility of trypanosomes by *Glossina* and the factors that influence the distribution in nature of *T. gambiense* and *T. rhodesiense*. The investigations of the Commission have not supplied any evidence of the occurrence of direct transmission of trypanosomes from man to man, and it is very improbable that it occurs in the endemic form of the disease. It is evident from experiment that direct transmission may function for a long time without affecting the strain, and it will be rare in nature for conditions to exist in which prolonged direct transmission can occur, but direct transmission may affect the constitution of a trypanosome in its natural surroundings, where the sequence of events that ensued in laboratory experiments may operate much more rapidly. The weight of evidence at present points to the metacyclic forms of the human trypanosomes as the main infecting agents, so that the power of these trypanosomes to develop cyclically in *Glossina* is of great importance. The virulence of a strain, however, appears to be entirely independent of its transmissibility. From his own experiments and those of other workers, the author concludes that the transmissibility of a trypanosome by *Glossina* is a function inherent in the trypanosome itself, but its close relationship with the vertebrate host makes it highly probable that the latter exerts a very potent influence on its conduct. It can, however, be affirmed that of the mammalian hosts ordinarily available to the trypanosome in nature, no species exerts a definite and immediate inhibitory effect on its transmissibility. The possibility that transmissibility is influenced by the tsetse-fly or by climate may apparently be excluded ; if the appropriate forms are taken up by the fly, they will develop. Loss of transmissibility constantly threatens the polymorphic trypanosomes in nature ; the longer the parasite remains in its host, the less transmissible it becomes. It appears probable that in general man is less readily infected by trypanosomes than are

the ruminants ; moreover, where *G. palpalis* is the principal or sole insect vector, its partiality for reptiles tends to reduce its contact with man. Consequently the human trypanosomes comparatively seldom enjoy the conditions that are necessary for epidemic spread. The frequent passage of the trypanosome from host to host, in the early stages of its sojourn in the mammal, aids its propagation in another way, there being frequent opportunities for superimposed infection of the same host with fresh strains, so that an animal whose trypanosomes have become non-transmissible can become again infective. In *G. palpalis* areas, *i.e.*, where *T. gambiense* is the human trypanosome, man is usually the principal and often the only mammal available for the trypanosome ; so far as is known, man is invariably susceptible to the metacyclic forms of *T. gambiense* inoculated by a tsetse-fly. In the game-tsetse areas, man generally provides only an alternative food-supply for the fly, and is of secondary importance to the trypanosome ; the human strains (*T. rhodesiense*) represent strains in general circulation among the game of the area, and can be transmitted back to game, their use of man as a host being largely incidental.

The sixth paper gives a brief account of the author's investigations on the polymorphic and game trypanosomes in situtunga antelopes and in *G. palpalis* on Damba Island, in Lake Victoria, from 1912 to 1926. The island is uninhabited, but the antelope have been hunted to a certain extent by natives, especially since 1921. The result has been a diminished contact between the antelope and *G. palpalis*, which is reflected in a diminishing percentage of flies infected with the game trypanosomes (*T. vivax* and *T. uniforme*) or the polymorphic trypanosome. The transference of the polymorphic trypanosome from antelope to antelope is therefore less frequent ; consequently, according to the author's theory, strains would be expected to lose their transmissibility. This is borne out by the discovery of a completely non-transmissible strain of the polymorphic trypanosome in the blood of an antelope in 1926.

Appendices show that the development of *T. gambiense* in *G. palpalis* is not affected by a feed on blood containing Bayer 205, after the infective feed, or, in the case of newly-emerged flies, by a preliminary feed on uninfected blood 24–48 hours before the infective feed.

A final appendix, by H. L. Duke, G. Lavier and M. M. Prates, describes the attraction, *in vitro*, of fragments of glands of *G. palpalis* for flagellates of *T. gambiense* from its gut. The glands of *Stomoxys* and *Musca domestica*, L., did not attract the trypanosomes. These experiments may or may not have any significance in indicating the manner in which the salivary glands become invaded.

LAVIER (G.). **Reports** [on the attempted Infection of Baboons by *Trypanosoma rhodesiense* and on a Morphological Study of the Polymorphic Trypanosomes].—*Final Rep. League of Nations Internat. Commiss. Human Trypanosomiasis*, pp. 117–141, 3 figs. Geneva, 1928.

The first of these two papers describes the failure of attempts to infect baboons with *Trypanosoma rhodesiense* by subcutaneous and intraspinal inoculations, although the resistance of the animals was previously lowered by other infections.

In the second paper the author gives an account of his investigations at Entebbe on the morphology in laboratory animals of various strains

of polymorphic trypanosomes isolated from man and animals. Some of the more important results have already been noticed [*R.A.E.*, B, xvi, 16, 158]. In connection with his theory that the trypanosomes in the body of the tsetse-fly are influenced by climate [xvi, 159], the author points out that the species of *Glossina* can be divided into two groups, one of humid regions, *G. palpalis*, R.-D., and *G. tachinoides*, Westw., transmitting *T. gambiense* and the Damba trypanosome, and another of dry regions, *G. morsitans*, Westw., *G. swynnertoni*, Aust., and *G. pallidipes*, Aust., transmitting *T. rhodesiense* and *T. brucei*. This suggests the possibility of the transformation of one type to another by a change of vector.

The morphological distinctions between the types of polymorphic trypanosomes are so slight that the author considers that on morphological grounds alone they would have to be regarded as a single species. *T. rhodesiense* and *T. brucei* are morphologically identical, and whether the former can be considered a distinct species or a race or strain of *T. brucei* depends on the completeness or otherwise of the immunity of man from the latter. The author considers that neither success nor failure of attempts to infect man with *T. brucei* could be accepted as final proof of identity or otherwise, as even a positive result would be open to the objection that the virus in the animal host might have been derived from man. He is of the opinion that only prolonged epidemiological investigations in regions where *T. rhodesiense* is common can solve the problem of its relationship to game.

Finally, the author discusses the phylogeny of the *T. brucei* group of trypanosomes, putting forward the view that cyclical transmission by *Glossina* is a recent development in this group, and that the group is derived from *T. evansi*. He points out that there is epidemiological evidence that the transmission of *T. evansi* by biting flies is not strictly mechanical, but that a reciprocal adaptation between the trypanosome and the invertebrate has already begun.

Prates (M. M.). **Reports** [on Investigations made at Entebbe].—*Final Rep. League of Nations Internat. Commiss. Human Trypanosomiasis*, pp. 143–244, 24 pls., 12 figs., refs. Geneva, 1928.

The first and third of these papers describe methods of diagnosing trypanosomiasis, and the second records the first discovery of posterior-nuclear forms of *Trypanosoma gambiense*, in guineapigs. The fourth paper gives an account of the successful cultivation, in Ponselle's medium, of *T. gambiense*, *T. rhodesiense*, *T. brucei* and the Damba trypanosome. No morphological difference between these polymorphic trypanosomes was observed at any stage of the cultures; all exhibited the recognised morphology of forms found in the gut of *Glossina*, no metacyclic or blood forms occurring. Attempts to cultivate trypanosomes from the guts and salivary glands of experimentally infected tsetse-flies failed, owing to contamination with bacteria. The author found no confirmation of Ponselle's suggestion that the differences in the osmotic pressure required for cultures of the various pathogenic trypanosomes may supply indications as to the receptivity of different species of *Glossina* for the various species of trypanosomes, all being cultivable in any of the concentrations of sodium chloride employed and all developing similarly in *G. palpalis*, R.-D. Trypanosomes did not develop in tsetse-flies fed on cultures inoculated under the skin of monkeys. Laboratory animals inoculated with cultures did not

become infected and did not exhibit immunity when subsequently inoculated with blood forms of trypanosomes.

In the fifth paper (pp. 179-225), the author gives a detailed account of the technique employed and the results obtained in an investigation of the blood in the gut of *Glossina palpalis* by means of the precipitin test. Before the precipitin test was carried out, the blood group was determined microscopically. Of 2,150 flies dissected, only 186 contained blood, and the blood in these belonged to the four groups in the following percentages: reptiles, 68·3; birds, 2·7; non-ruminant mammals, 22·5; and ruminants, 6·5. Only 43 positive precipitin reactions were obtained, the source of the blood in these cases being as follows: monitor, 21; crocodile, 6; man, 6; hippopotamus, 4; ruminants, 2; and 4 doubtful. These results, and feeding experiments with laboratory-bred flies, indicate that *G. palpalis* can feed on the blood of any animals that occur in the localities where the environment is suitable for its own needs; there is, however, reason to believe that the flies show a preference for certain animals, although the results obtained with the precipitin test do not necessarily represent the order of preference, on account of difficulties inherent in the method. All the specimens of *G. palpalis* were captured near Entebbe and were attracted to the fly-boys while searching for food. The blood was in nearly all cases so modified by digestion that the precipitin reactions were very feeble. The few well-marked positive reactions were obtained with anti-human serum, probably because the flies had fed on the fly-boys just before being caught. The author suggests that the complement fixation test would furnish better results than the precipitin test in identifying blood from the alimentary tract of tsetse-flies.

The sixth paper contains notes on the parasitic organisms found in the blood contained in specimens of *G. palpalis*, these giving in some cases additional evidence as to the source of the blood. From 16 to 24 per cent. of the flies dissected within 4-5 hours of capture at Entebbe contained *Trypanosome grayi*, generally in association with the nucleated red blood cells of reptiles, while of those dissected after 1–3 days, from 0 to 3 per cent. only contained this flagellate; *T. grayi* was not found in 112 flies from the Kami river, where there are no crocodiles. The metacyclic forms of *T. grayi* were seen in the posterior extremity of the gut of *G. palpalis*, but young crocodiles failed to become infected either when inoculated with these forms or when bitten by infected flies. Haemogregarines were frequently found in the gut of *G. palpalis*, generally associated with nucleated red blood cells of reptiles; similar haemogregarines were found in the blood of a crocodile. Long bacilli, the presence of which is apparently incompatible with that of trypanosomes, were found in the gut of 139 out of 873 wild or laboratory-bred specimens of *G. palpalis* examined for their presence.

In the seventh paper, the author gives an account of the organisation of experimental work with tsetse-flies at the Entebbe laboratory.

PERUZZI (M.). **Pathologico-anatomical and serological Observations on the Trypanosomiases.**—*Final Rep. League of Nations Internat. Commiss. Human Trypanosomiasis*, pp. 245-323, 10 pls., refs. Geneva, 1928.

In a paper on *post-mortem* investigations of 53 monkeys (*Cercopithecus* sp.) infected with recently isolated strains of trypanosomes of human

and animal origin, the author distinguishes three types of morbid anatomical lesions, the first characterising the pathogenic action of human trypanosomes of regions infested with *Glossina palpalis*, R.-D., the second that of the human and animal trypanosomes of the regions of *G. morsitans*, Westw., and *G. swynnertoni*, Aust., and the third that of animal trypanosomes from Damba Island (region of *G. palpalis*).

In a paper on trypanosomal myiocarditis, which frequently causes death in inoculated monkeys, it is stated that the gravest and most frequent forms are due to trypanosomes of human and animal origin conveyed by *G. morsitans* and *G. swynnertoni* and to those of animal origin conveyed by *G. palpalis*, less acute forms being found in those of human origin conveyed by *G. palpalis*.

In another paper, the author states that the choroid plexuses are the site of early extravascular deposits of trypanosomes of human and animal origin from *G. morsitans* and *G. swynnertoni* ; these penetrate into the cerebro-spinal fluid in large numbers, but are rapidly destroyed, the cerebro-spinal fluid being a defensive mechanism against the invasion of trypanosomes until its albuminoid content is raised. It contains demonstrable trypanosomes when the phenomena of meningo-encephalitis are definitely established. This happens particularly, but not exclusively, in advanced forms of chronic infections, caused by strains of human or animal origin from *G. palpalis*, and also when the changes in the cerebro-spinal fluid are very pronounced.

[Van Hoof (L.) & Duke (H. L.).] **Epidemiology of Sleeping-sickness in the *G. palpalis* and *T. gambiense* Areas and various Observations on Treatment.**—*Final Rep. League of Nations Internat. Commiss. Human Trypanosomiasis*, pp. 325–388, 7 pls., 4 maps, refs. Geneva, 1928.

Accounts are given of investigations on sleeping-sickness in three different areas, where the trypanosome is *Trypanosoma gambiense* and the vector *Glossina palpalis*, R.-D., *viz.*, the Semliki valley, Belgian Congo (between Lake Albert and Lake Edward), the Upper Uele district, Belgian Congo (in the extreme north, bordering on the Anglo-Egyptian Sudan), and the Budama and Kavirondo districts of Uganda and Kenya, north-east of Lake Victoria. The first and third of these accounts are by Van Hoof, and the second by Duke and Van Hoof. Some general conclusions drawn from the investigations are given in a fourth paper by Van Hoof.

The topography and economic conditions of the Semliki valley are discussed. The population was moved from the immediate neighbourhood of the river to the higher ground in 1922–24, this being the only means of preventing contact between the scattered natives and the innumerable breeding-places of *G. palpalis*. This measure, in conjunction with medicinal treatment, has transformed a very deadly epidemic outbreak into an endemic, which is, however, serious, and shows a tendency to spread, creating fresh foci, the nature of the trypanosome, the biological conditions of the tsetse-fly and the opportunities for contact between it and man being responsible for this. There is every likelihood that the endemic will spread and that the trypanosome, which is sometimes arsenic-fast, may spread through the neighbouring territories. The effects of chemical prophylaxis are bound to be checked by the continual importation of fresh strains of

trypanosomes, until supervision of the movements of persons and traffic becomes the rule, and the foci where *G. palpalis* depends exclusively on man can be evacuated or cleared by means of deforestation. Tsetse-flies are comparatively little in evidence in the region, but *G. palpalis* occurs on all the rivers, possibly even at high altitudes in the hot seasons. Other species observed were *G. pallidipes*, Aust., *G. fuscipleuris*, Aust., and *G. fusca*, Wlk., or *G. brevipalpis*, Newst.

The endemic in the Upper Uele district is of long standing, but has little tendency to extend; the reasons for this are that the disease is very sporadic, the natives do not live in compact settlements, and *G. palpalis* occurs in small numbers, although probably present throughout the network of rivers. In the dry season, males of *G. palpalis* predominated on the large rivers, but on the smaller streams, in which the water level was low, the flies were scarce and the percentage of females was higher, reaching 70 per cent. in one case. The fly obtains a large part of its food from reptiles and game, particularly on the large rivers, in which crocodiles abound; along the smaller streams, where most of the villages are situated, it depends on man to a considerable degree, at least in the dry season. *G. morsitans*, Westw., which was found in the district in 1914 [*R.A.E.*, B, iv, 56], was not seen by the authors. A single specimen of *G. fusca* or *G. brevipalpis* was taken in thick forest, and *G. pallidipes* was found to be very abundant in the close vicinity of *G. palpalis* in the Kawa forest on the western bank of Lake Albert, but no flagellates were found in 25 individuals that were dissected. It is probable that the trypanosome is preserved in the district by occasional individuals of *G. palpalis* whose salivary glands are infected; mechanical transmission could not be reconciled with the sporadic nature and moderate extent of distribution. Direct action against *G. palpalis* is practically impossible; it must be confined to a few judiciously selected places, and the work must be thorough and constantly renewed.

The account of the investigation in Budama and Kavirondo deals with a second visit to the area, and supplements the report on the first visit [*R.A.E.*, B, xvii, 37]. Infection in all new cases encountered was traced to one or other of the breeding grounds of *G. palpalis* that were previously found to be dangerous. The view is confirmed that the whole endemic zone is split up into a few foci, limited in area, and in some cases with few tsetse-flies, some of which can be definitely delimited. Such foci can be destroyed without any great labour or mass removal of the inhabitants.

In his general remarks on sleeping-sickness in regions of *T. gambiense* and *G. palpalis*, Van Hoof emphasises the importance of the restricted area of breeding grounds surrounded by cases of sleeping-sickness. Here and there, as sometimes in the Semliki valley, the sole prey of the fly is man; consequently if a virulent trypanosome is introduced, it spreads rapidly, and if an insufficient arsenical treatment is given, it may become arsenic-resistant after a number of passages, or may produce reinfections in cases that have already been treated. A large but scattered population in contact with tsetse-flies distributed all over the district, as in the Upper Uele, may escape even if a pathogenic trypanosome is introduced, or only sporadic cases may occur; in such cases the degree of transmissibility of the trypanosome is an important factor. Some of the strains in the endemic areas visited have lost in nature the power of being transmitted by *G. palpalis*. No fact in epidemiology indicates the existence of immunity or appreciable

resistance in man. There is as yet nothing to show that there are any reservoirs of the virus other than man and the infected tsetse-fly, nor does it appear that the disease is transmitted except by cyclically infected tsetse-flies. Prophylaxis directed solely against the human reservoir of the virus may fail if the virus subsists in the fly and the fly remains in contact with man. The epidemiological investigations confirm the value of prophylactic measures long known but not everywhere carried out, including a scientific campaign against *Glossina*, requiring thorough entomological information, on the basis of which breeding grounds known to be dangerous can be destroyed and natives can be moved and regrouped, thus avoiding needless and costly deforestation and unnecessarily large mass-displacements of population.

A paper by Van Hoof gives the results obtained in the use of an arsenical preparation against *Spirochaeta duttoni* in man, transmitted by *Ornithodorus moubata*, Murr., in the Semliki valley. The tick has only recently been introduced into this district, but it has rapidly become a scourge there.

Kleine (F. K.), Van Hoof (L.) & Duke (H. L.). **General Recommendations for the Control of Sleeping-Sickness in African Dependencies.**—*Final Rep. League of Nations Internat. Commiss. Human Trypanosomiasis*, pp. 389–392. Geneva, 1928.

The principal recommendations are as follows: the movement of natives should be controlled; the census of infected natives should be thorough and complete; natives infected with trypanosomiasis should be treated; and heavily infected zones should be evacuated. The last is an emergency measure, only to be applied in special cases, and before resorting to it, organised concentration of population should be tried in carefully chosen areas, where contact between fly and man can be eliminated or adequately controlled and reduced. Clearing measures are generally very costly, and unless carried out under the control of trained entomologists, are of little permanent benefit; in regions infested with *Glossina palpalis*, R.-D., such measures should be restricted to much-frequented places, and they must be thorough and well maintained, or they will be useless.

Casazza (R.). **Sui Dermatoendozoi, a proposito di un nuovo parassita. (Creeping Disease e Pseudo-scabbia da** *Dermolecanium migrans*.) [*D. migrans*, a new Parasite causing Creeping Disease.]—*Boll. Soc. med.-chir. Pavia*, 1928, reprint 37 pp., 2 pls., 7 refs. Pavia, 1928.

The first part of this paper reviews the various Arthropods and Helminths causing creeping disease and scabies. The second part deals with two cases, observed at Pavia in 1927, due to a parasite of which larvae were obtained from the skin. This larva is briefly described, with figures, by Prof. E. Zavattari as *Dermolecanium migrans*, gen. et sp. n., a Coccid of the subfamily Lecanhinae. It is pointed out that Coccids have never before been recorded as parasites of man or animals. Zavattari states that the larvae closely resemble those of many species of *Lecanium* (*Eulecanium*) and may prove to be those of a known species. In the first of these cases, the affection resembled scabies, in the second cutaneous myiasis.

PAPERS NOTICED BY TITLE ONLY.

PATERSON (G. C.), SHANNON (R. C.) & DEL PONTE (E.). **Observaciones sobre la distribución de los flebótomos de las provincias del noroeste de la República Argentina.** [Observations on the Distribution of *Phlebotomus* in the Provinces of North-west Argentina.]—*Rev. Univ. Buenos Aires*, xxiv (2), pp. 1267–1272. Buenos Aires, September 1927. [See *R.A.E.*, B, xvi, 13.]

CORDERO (E. H.), VOGELSANG (E. G.) & COSSIO (V.). *Phlebotomus gaminarai* **n. sp. Nueva especie de flebótomo del Uruguay.**—*4. Reun. Soc. argentina Pat. reg. Norte* [in] *Bol. Inst. Clin. quirurg.*, iv, no. 28–31, pp. 649–652, 2 figs., 3 refs. Buenos Aires, 1928.

JOAN (T.). **Nota sobre el** *Amblyomma neumanni*, *A. testudinis* **y** *A. auriculare*. [Notes on the Synonymy of *A. neumanni*, *A. testudinis* and *A. auriculare*.]—*4. Reun. Soc. argentina Pat. reg. Norte* [in] *Bol. Inst. Clin. quirurg.*, iv, no. 28–31, pp. 665–667, 1 pl. Buenos Aires, 1928.

CORDERO (E. H.) & VOGELSANG (E. G.). **Dos nuevas especies del género** *Cimex* **parásitas de aves.** [Two new Species of the Genus *Cimex* parasitising Birds in Uruguay.]—*4. Reun. Soc. argentina Pat. reg. Norte* [in] *Bol. Inst. Clin. quirurg.*, iv, no. 28–31, pp. 671–676, 4 figs. Buenos Aires, 1928.

DALLAS (E. D.). **Nota sobre Lepidopterismo en la República Argentina.** [A Note on Affections produced by urticating Lepidopterous Larvae in Argentina.]—*4. Reun. Soc. argentina Pat.reg. Norte* [in] *Bol. Inst. Clin. quirurg.*, iv, no. 28–31, pp. 691–694, 7 refs. Buenos Aires, 1928.

NATVIG (L. R.). **Die norwegische Finnmarks-Expedition. Culicidae.** [The Norwegian Expedition to Finland. CULICIDAE.] —*Norsk ent. Tidsskr.*, ii, no. 5, pp. 241–249, 4 figs., 13 refs. Oslo, 1928.

DE BUCK (A.), SCHOUTE (E.) & SWELLENGREBEL (N. H.). **Studien über Anophelismus ohne Malaria in der Umgebung Amsterdams.** [Studies on Anophelism [*Anopheles maculipennis*, Mg.] without Malaria in the Vicinity of Amsterdam.]—*Centralbl. Bakt.*, (1) Orig., cix, no. 5–6, pp. 251–284, 11 figs., 1 pl. Jena, 7th November 1928. [See *R.A.E.*, B, xvi, 242.]

IYENGAR (M. O. T.). **Structure and Function of the Contractile Thoracic Appendages of the** *Anopheles* **Larvae.**—*Ind. J. Med. Res.*, xvi, no. 2, pp. 281–296, 4 pls., 4 figs., 3 refs. Calcutta, October 1928.

BARRAUD (P. J.). **A Revision of the Culicine Mosquitoes of India. Part xxiv. The Indian Species of the Subgenera** *Skusea* **and** *Aëdes*, **with Descriptions of eight new Species, and Remarks on a new Method for identifying the Females of the Subgenus** *Aëdes*.—*Ind. J. Med. Res.*, xvi, no. 2, pp. 357–375, 8 pls. Calcutta, October 1928.

MCCOMBIE YOUNG (T. C.) & ABDUL MAJID (S.). **A Variety of** *Anopheles karwari* [var. *majidi*, n.] **collected in Coorg, S. India.**—*Ind. J. Med. Res.*, xvi, no. 2, pp. 469–471, 1 pl., 4 refs. Calcutta, October 1928.

NIESCHULZ (O.). **Zoologische Beiträge zum Surraproblem. xxii. Uebertragungsversuche mit** *Anopheles fuliginosus*, **Gil.** [Zoological Contributions to the Problem of Surra. xxii. Transmission Experiments with *A. fuliginosus*.]—*Centralbl. Bakt.*, (1) Orig., cix, no. 5–6, pp. 327–330, 5 refs. Jena, 7th November 1928.

Positive results in the transmission of surra from horse to horse by *Anopheles fuliginosus*, Giles, have been obtained at Buitenzorg, Java. Such transmission, even if uncommon, is likely to occur in nature owing to the abundance of the mosquitos and their persistence in attempting to resume an interrupted feed.

BORDAS (M.). *Leptomonas* **de plantas.**—*Rev. Univ. Buenos Aires*, xxiv (2), pp. 920–934, 2 figs., 1 pl., 59 refs. Buenos Aires, September 1927.

This paper reviews briefly the work that has been done on *Herpetomonas* (*Leptomonas*) infecting plants and the relation existing between these organisms and similar ones in insects.

COLLIER (W. A.). **Die Derrengadera und ihre Bekämpfung.** [Derrengadera and its Control.]—*Deuts. tierärztl. Wschr.*, xxxvi, no. 45, pp. 749–752. Hanover, 10th November 1928.

A form of trypanosomiasis due to *Trypanosoma venezuelense*, occurs in Venezuela in horses, mules and donkeys. In nature, dogs are sometimes infected, and also *Canis azarae*, which is common in the plains, and monkeys (*Mycetes ursinus*). The capybara (*Hydrochoerus capybara*) is regarded as the natural reservoir of the trypanosome, and it is therefore destroyed. The disease occurs in various clinical forms. It has previously been found that small animals can be infected by means of the intestinal contents of *Tabanus importunus*, Wied., and the general opinion that this Tabanid effects mechanical transmission in nature is supported by epidemiological conditions. It has been suggested that *Stomoxys calcitrans*, L., plays some part in transmission owing to its enormous abundance in the plains from June to August, and a similar rôle may be ascribed to *Lyperosia irritans*, L., and *L. minuta*, Bezzi, though they are rare in many parts of Venezuela.

NICOLLE (C.) & ANDERSON (C.). **Sur l'intérêt que présentent les recherches concernant les spirochétoses transmises par les tiques pour la connaissance de la pathologie nord-argentine.**—*4. Reun. Soc. Argentina Pat. reg. Norte* [in] *Bol. Inst. Clin. quirurg.*, iv, no. 28–31, pp. 9–12. Buenos Aires, 1928.

Reference is made to a case of relapsing fever of unknown origin in Jujuy. The existence in the Old World of various forms of relapsing fever transmitted by ticks suggests the occurrence of similar forms of spirochaetosis in Argentina, in the north-western regions of which species of *Ornithodorus* are found. The various new forms of relapsing fever recorded since 1922 are reviewed.

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IDOYAGA (V.). **Patología médico militar del chaco paraguayo.** [The medical Pathology of Troops in the Chaco Region of Paraguay.]—*4. Reun. Soc. argentina Pat. reg. Norte* [in] *Bol. Inst. Clin. quirurg.*, iv, no. 28–31, pp. 20–36. Buenos Aires, 1928.

This paper includes a note on the occurrence of malaria in the Chaco region of Paraguay and a list of the blood-sucking Diptera found there. The species recorded include *Anopheles pseudopunctipennis*, Theo., *A. argyritarsis*, R.-D., *A tarsimaculatus*, Goeldi, *A. bachmanni*, Petr., *Aëdes argenteus*, Poir. (*Stegomyia fasciata*, F.), *Phlebotomus intermedius*, Lutz & Neiva, *P. migonei*, França, and *P. araozi*, Paterson & Shannon.

DAVIS (N. C.) & RICKARD (E. R.). **Plan de lucha contra la malaria urbana en el norte argentino.** [Plan of Work against urban Malaria in the North of Argentina.]—*4. Reun. Soc. argentina Pat. reg. Norte* [in] *Bol. Inst. Clin. quirurg.*, iv, no. 28–31, pp. 119–130, 6 refs. Buenos Aires, 1928.

Since 1925 the Rockefeller Foundation has co-operated with the Argentine Public Health Service in a study of work against malaria in towns and villages. The measures against mosquitos include drainage, the clearing of vegetation from canals, oiling and the use of larvicides such as Paris green. Methods for checking the results include examination of the breeding-places and the capture of adult mosquitos indoors and by means of bait-animals. If examination of the breeding-places reveals the presence of *Anopheles pseudopunctipennis*, Theo., anti-larval measures are at once taken. From October 1925 to February 1928, this species represented 99·52 per cent. of the adults captured indoors, numbering about 40,000.

RICKARD (E. R.). **Estudios sobre el alcance de vuelo del *Anopheles pseudopunctipennis* en el norte argentino. (Informe preliminar.)** [Studies on the Range of Flight of *A. pseudopunctipennis* in the North of Argentina. Preliminary Communication.]—*4. Reun. Soc. argentina Pat. reg. Norte* [in] *Bol. Inst. Clin. quirurg.*, iv, no. 28–31, pp. 131–142, 3 figs., 5 refs. Buenos Aires, 1928.

Experiments show that in northern Argentina *Anopheles pseudopunctipennis*, Theo., has a normal flight range of 2½ miles. Some individuals can fly 3¾ miles. Winds contrary to the direction of flight, dense belts of forest, and the presence of animals in meadows crossed by the line of flight do not appear to prevent distant houses from being invaded.

RICKARD (E. R.), DÍAZ QUIETA (P.) & NÚÑEZ (A.). **Investigaciones sobre la aplicabilidad como larvicida ventajoso y de bajo precio de los productos de desecho de la molienda de la caña de azúcar** [Investigations on the Value of the Waste Products of Sugar-cane Crushing as a good and cheap Larvicide.]—*4. Reun. Soc. argentina Pat. reg. Norte* [in] *Bol. Inst. Clin. quirurg.*, iv, no. 28–31, pp. 153–156. Buenos Aires, 1928.

Three waste products of sugar-cane crushing were examined with the object of finding if they would prove effective mosquito larvicides, as it had been noticed that Anopheline larvae did not occur in channels carrying away such waste products from cane mills. None of them, however, was effective except in doses too large to be practical.

RICKARD (E. R.) & PÉREZ (A.). **Los larvicidas en la práctica de saneamiento. Experiencias con el petróleo y el verde de Paris.** [Larvicides in Practical Work. Experiments with Petroleum and Paris Green.]—*4. Reun. Soc. argentina Pat. reg. Norte* [in] *Bol. Inst. Clin. quirurg.*, iv, no. 28–31, pp. 166–171. Buenos Aires, 1928.

Tests made in northern Argentina with gas-oil (a petroleum derivative) and with Paris green containing 54 per cent. of arsenic showed both to be effective in waters where there are few Anopheline larvae and no pupae. Where larvae and pupae are abundant, the oil is more effective, but in large areas of water far from inhabited places, Paris green is to be preferred on account of cost, the oil costing thirty-six times as much to buy and three times as much to apply.

MAZZA (S.) & RICKARD (E. R.). **Investigación sobre las relaciones entre paludismo y cultivo del arroz en la provincia de Tucumán.** [An Investigation on the Relation between Malaria and Rice Cultivation in the Province of Tucumán.]—*4. Reun. Soc. argentina Pat. reg. Norte* [in] *Bol. Inst. Clin. quirurg.*, iv, no. 28–31, pp. 175–180. Buenos Aires, 1928.

Examinations of water in rice-fields in the south of Tucumán, northern Argentina, were made in March and April 1928, during the malarial season. Only larvae of *Anopheles albitarsis*, Arrib., *A. tarsimaculatus*, Goeldi, and *A. argyritarsis*, R.-D., were found. *A. pseudopunctipennis*, Theo., the most important and perhaps the sole vector of malaria in northern Argentina, was not observed in the rice-fields, though adults of this species constantly predominate in houses near the fields. *A. albitarsis* and *A. tarsimaculatus* were only observed in one house, 57 examples of the former and 2 of the latter being taken. Some unusual factor, perhaps the absence of animals, must be the reason for the exceptional occurrence of *A. albitarsis* indoors. Malaria is no more common in houses near the rice-fields than in those at a distance from them.

GAMINARA (A.) & TALICE (R. V.). **Dos notas de entomologia médica.**—*4. Reun. Soc. argentina Pat. reg. Norte* [in] *Bol. Inst. Clin. quirurg.*, iv, no. 28–31, pp. 653–656. Buenos Aires, 1928.

The first of these notes gives records of Anophelines obtained in Uruguay from January to March 1928. *Anopheles argyritarsis*, R.-D., was found in various localities. Records new for Uruguay are *A. annulipalpis*, Arrib., *A. maculipes*, Theo., and possibly *A. albitarsis*, Arrib. No malaria was observed.

In the second note it is stated that the Reduviid, *Triatoma rubrovaria*, Blanchard, occurs throughout Uruguay. In one locality some of the bugs harboured developmental forms of *Trypanosoma* (*Schizotrypanum*) *cruzi*, but this trypanosome was not found in man or animals. *Triatoma circummaculata*, Stål, was observed in small numbers, but did not contain flagellates.

NEIVA (A.). **Sobre la presencia en Salta del** *Spiniger domesticus* **César Pinto reduvido insectívoro frecuentemente encontrado en los domicilios.** [On the Occurrence in Salta of *S. domesticus*, an insectivorous Reduviid frequently found in Dwellings.]—*4. Reun. Soc. argentina Pat. reg. Norte* [in] *Bol. Inst. Clin. quirurg.*, iv, no. 28–31, pp. 657–659, 1 pl. Buenos Aires, 1928.

The Reduviid, *Spiniger domesticus*, Pinto, originally described from Brazil, has been found in the province of Salta, northern Argentina. The original description is reproduced, with some additional notes.

GAMINARA (A.). **Abcesos miásicos subcutáneos.** [Subcutaneous myiasic Sores.]—*4. Reun. Soc. argentina Pat. reg. Norte* [in] *Bol. Inst. Clin. quirurg.*, iv, no. 28–31, pp. 695–696. Buenos Aires, 1928.

Brief notes are given on cases observed in Uruguay in which *Cochliomyia macellaria*, F., was found infesting man. The larvae were responsible for primary sores instead of infesting pre-existing lesions as they usually do.

LAHILLE (F.). **Nota sobre la garrapata espinosa** *Ornithodorus megnini* **(A. Dugès) Neumann.** [A Note on the Spinose Tick, *O. megnini*.]—*4. Reun. Soc. argentina Pat. reg. Norte* [in] *Bol. Inst. Clin. quirurg.*, iv, no. 28–31, pp. 660–664, 1 pl. Buenos Aires, 1928.

Ornithodorus megnini, Dugès, is the only species of this genus known in Argentina, but *O. talaje*, Guér., has recently been found in Uruguay and is likely to be introduced.

VOGELSANG (E. G.). **Garrapatas (Ixodidae) del Uruguay.**—*4. Reun. Soc. argentina Pat. reg. Norte* [in] *Bol. Inst. Clin. quirurg.*, iv, no. 28–31, pp. 668–670. Buenos Aires, 1928.

Among the ticks recorded are *Amblyomma maculatum*, Koch, from fowls, cattle, sheep, and dogs; *A. neumanni*, Ribaga, from cattle; and *Boophilus* (*Margaropus*) *annulatus microplus*, Can., from cattle, sheep, horses, and dogs.

CORDERO (E. H.), VOGELSANG (E. G.) & COSSIO (V.). *Ornithodorus talaje* **(Guérin-Méneville) y su presencia en el Paraguay y en el Uruguay.** [*O. talaje* and its Occurrence in Paraguay and Uruguay.]—*Physis*, ix, no. 32, pp. 125–127, 4 figs. Buenos Aires, 10th August 1928.

Ornithodorus talaje, Guér., which was found in Paraguay in 1927, has recently been observed in Uruguay among stones at a distance from dwellings, where it occurred together with the Reduviid, *Triatoma infestans*, Klug. The characters that differentiate it from allied ticks are described.

DA COSTA LIMA (A.). **Notas sobre a biologia do *Telenomus fariai*, Lima, parasito dos ovos de *Triatoma*.** [Notes on the Biology of *T. fariai*, an Egg Parasite of *Triatoma*.]—*Mem. Inst. Oswaldo Cruz*, xxi, no. 1, pp. 201–218, 3 pls., 5 refs. Rio de Janeiro, 1928. (In Portuguese and English.)

The Scelionid, *Telenomus fariai*, da Costa Lima, is an endophagous parasite of the eggs of the Reduviid, *Triatoma megista*, Burm., in Brazil. In breeding experiments both sexes begin to die at the end of about 15 days; the females appear to live longer than the males, and one lived for 45 days. In breeding isolated females the longest life was 37 days during which eggs were laid in 52 eggs of *T. megista*. Females begin ovipositing in the eggs of *Triatoma* some hours after emergence. In the laboratory, eggs are laid in eggs of both *T. megista* and *T. sordida*, Stål, but in nature in those of the former species only. The eggs of Pentatomids were not parasitised. The life-cycle of *Telenomus* required from 27 to 35 days at a moderate temperature, but is probably shorter in summer. Parthenogenesis is normal, the offspring being males. There appears to be a possibility of employing *T. fariae* to control *Triatoma megista*, the principal carrier of *Trypanosoma* (*Schizotrypanum*) *cruzi*, which is not heavily parasitised in nature, by artificial breeding and liberation in dwellings. The life-cycle of the parasite is relatively rapid compared with that of its host.

DE ANDRADE (E. N.). **Pesquizas sobre o berne, sua frequencia no homen, nos bovinos, suinos e equideos e da applicação de um novo methodo de provavel efficiencia para o seu combate.** [Investigations on Infestations by the Larva of *Dermatobia hominis*, its frequency in Man, Cattle, Pigs, and Equines, and on the Application of a new and probably effective Measure against it.]—*Bol. biol.*, no. 6, pp. 25–31. S. Paulo, 26th May 1927.

Owing to the danger of fire, the undergrowth in certain eucalyptus forests in S. Paulo, Brazil, requires clearing, and this is best effected by pasturing animals. Cattle cannot be used as they are constantly infected by *Dermatobia hominis*, Say, but horses and mules have been employed with success. Many cases thought to be due to *D. hominis* are actually caused by *Cochliomyia* (*Chrysomyia*) *macellaria*, F. It appears that in the absence of cattle, horses and mules are not attacked by the former, but this point is being further investigated. Over 44 per cent. of 819 people living in or near the eucalyptus plantations were infested. The percentages of infestation among stock in the neighbourhood were 100 in cattle, 9·3 in horses, 17 in mules, 5 in donkeys, and 12·3 in pigs.

PRADO (A.). **As moscas e as cameras de fermentação.** [Flies and Refuse Fermentation Chambers.]—*A Folha medica*, ix, no. 28, pp. 333–335. Rio de Janeiro, 5th October 1928.

Observations made in S. Paulo, following the installation of the Italian Beccari system of concrete fermentation chambers in which town garbage is converted into an inodorous manure, have shown that storage for 45 days or more in such chambers does not destroy the fertilising power of the resultant manure, while the vegetable garbage becomes unsuitable for the breeding of flies after storage for over 30 days. A list of the flies occurring on vegetable garbage is given.

Sievers W. (H. K.). **Aparición de la larva de** *Hypoderma bovis* **en Chile.** [The Appearance of the Larva of *H. bovis* in Chile.]—*Rev. chil. Hist. nat.*, xxxii, pp. 81–82. Santiago, 1928.

Hypoderma bovis, DeG., does not occur in Chile, but larvae are sometimes observed in cattle imported from the United States. These animals reach Chile, however, at a season unfavourable for the development of the larvae, which die and gradually disintegrate, leaving a scar. There is therefore no danger of this fly becoming established in Chile.

Séjournant (—). **Envahissement péritonéal par des larves d'hypoderme. Péritonite consécutive.** (Abstract.)—*Rev. vét.*, lxxx, p. 680. Toulouse, December 1928.

In *post-mortem* examinations first-stage larvae of *Hypoderma bovis*, DeG., were found in the abdominal cavity of two heifers, and the author is of the opinion that in passing through the walls of the stomach and intestines these larvae had disseminated pathogenic organisms from the digestive tract in the peritoneum.

Felt (E. P.). **Insects and Health.**—*New York State Mus. Bull.*, no. 274, pp. 3–57, 23 figs., 3 pp. refs. Albany, N.Y., April 1928.

This is a résumé of information on the insects that affect the health and comfort of man in various parts of the world, particularly those that are carriers of disease, with notes on measures against many of them, and an extensive bibliography.

Herms (W. B.). **The Coachella Valley (California)** *Hippelates* **Fly Project.**—*J. Econ. Ent.*, xxi, no. 5, pp. 690–693, 1 pl., 2 refs. Geneva, N.Y., October 1928.

Careful studies to determine the breeding habits of *Hippelates pusio*, Lw., originally identified as *H. flavipes*, Lw., and said to be an important vector of " pink-eye " [catarrhal conjunctivitis] [*R.A.E.*, B, xiv, 222], have so far failed to throw any light on the question. An adobe laboratory suitable for investigations in desert regions, which has now been built for this project, is described. Although many of the baits employed, such as liver, kidney, moistened dried blood, etc., proved attractive to the flies, no oviposition was observed. Among many plants tested, Bermuda grass [*Cynodon dactylon*] proved very attractive, but no immature stages have been found on this grass, or in its stems or roots.

Doane (R. W.). **Insects vs. Poliomyelitis: Negative Evidence.**—*J. Econ. Ent.*, xxi, no. 5, pp. 693–697. Geneva, N.Y., October 1928.

Studies carried out in 1928 indicate that insects were probably not concerned with the spread of a light epidemic of poliomyelitis that occurred on the Stanford Campus.

Herms (W. B.). **The Effect of different Quantities of Food during the larval Period on the Sex Ratio and Size of** *Lucilia sericata*, **Meigen, and** *Theobaldia incidens* **(Thom.).**—*J. Econ. Ent.*, xxi, no. 5, pp. 720–729, 4 refs. Geneva, N.Y., October 1928.

In a series of experiments carried out in May 1928, larvae of *Lucilia sericata*, Mg., were removed in batches of one hundred, after feeding

for 30 hours on beef lung, at six hour intervals, the longest period being 96 hours. The size of the resulting flies became in general increasingly larger as the feeding period was increased, while the sex ratio varied from a large preponderance of males in flies resulting from underfed larvae to a preponderance of females in those fed for longer periods. The longest wings were to be found among flies that had fed for 54–60 hours, and the shortest wings in those that had fed for 42. The average size of the females was always greater than that of the males, except after 42 hours feeding or less, when the males were a little larger.

Adult mosquitos were bred from larvae of *Theobaldia incidens*, Thomson, in lots of one hundred in distilled water to which yeast was added in quantities ranging from 0·5 to 5 gm. The results showed a tendency for males to preponderate with larger quantities of food and females with smaller quantities. The average wing length of the mosquitos varied from 4 mm. for 0·5 gm. of yeast to 4·6 mm. for 5 gm., although the average wing length of those from larvae reared on 3 gm. of yeast was 4·7 mm.

PARMAN (D. C.), LAAKE (E. W.), BISHOPP (F. C.) & ROARK (R. C.). **Tests of Blowfly Baits and Repellents during 1926.**—*Tech. Bull. U.S. Dept. Agric.*, no. 80, 14 pp., 1 fig., 7 refs. Washington, D.C., September 1928.

This paper is a report on further studies of repellents for blow-flies [*R.A.E.*, B, xv, 194; etc.], the work being carried out in Texas. The value of the results obtained in previous years was in some cases rendered uncertain by the small number of flies visiting the site of the experiments. A study was therefore made of the factors affecting the attractiveness of the bait. Rabbit meat was not more attractive to blow-flies than fresh beef liver. Liver proved more attractive in pieces than ground, but pieces weighing 6 or 8 oz. were not more attractive than those weighing 4 oz. Fresh liver is most attractive to *Lucilia* on the first day of exposure, but most attractive to *Cochliomyia macellaria*, F., on the second day, when the larvae of *Lucilia* are present; in warm weather, there is only a short period during which liver is strongly attractive to *C. macellaria*. More flies were attracted to baits in glass jars than to those in earthenware crocks or enamel pans, and more were attracted to baits in jars in a shed than to those in jars placed in boxes in the open.

The tests to determine the relative efficacy of various powders and liquids were made with 4 oz. pieces of beef liver in glass jars placed in a shed. The tabulated results show the numbers of *C. macellaria* and *Lucilia* visiting the treated baits, as well as the ratio of these to the number visiting the untreated ones. Some of the conclusions have been noticed briefly elsewhere [*R.A.E.*, B, xvi, 135]. The most efficient repellents can be classified in three groups, *viz.*, products obtained by the destructive distillation of the long-leaf pine (*Pinus palustris*), pyrethrum powder, and strong inorganic antiseptics. Of the first group, pine tar, pine oil, turpentine and wood naphtha are somewhat irritating to animal tissue; of the last, mercury bichloride is very poisonous. Preliminary tests on animals infested with *C. macellaria* indicate that copper compounds, the repellent properties of which must be largely due to their ability to check or change the decomposition of meat, and pyrethrum powder will not prove of practical value. Pine-

tar oil is being extensively employed on ranches; its value as a repellent is probably largely due to the phenols that it contains. The methods by which various substances exercise a repellent effect on blow-flies are discussed.

TOURNIER (E.) & GUÉNOLÉ (A.). **Epidémie de dengue hivernale en Chine du Nord.**—*Bull. Soc. Path. exot.*, xxi, no. 8, pp. 617–619. Paris, 1928.

An account is given of a small outbreak of dengue in the garrison at Shanghai-Kwan during February 1928. At this time of year in North China, where the temperature falls to —20° C. [—4° F.], there is no insect capable of transmitting the disease, and infection must therefore have been due to direct contact.

YAKIMOFF (W. L.), BÉLAWINE (W. S.), RASTEGAÏEFF (E. F.) & NICOLSKY (S. N.). **La répartition géographique des piroplasmes et des tiques au Nord du Caucase.**—*Bull. Soc. Path. exot.*, xxi, no. 8, pp. 644–646. Paris, 1928.

Lists are given of the blood parasites and ticks found infesting cattle in various regions of the North Caucasus. The ticks recorded are *Boophilus annulatus calcaratus*, Neum., *Hyalomma aegyptium*, L., *Dermacentor reticulatus*, F., *Rhipicephalus rossicus*, Yak. & Kohl-Yak., and *Ixodes* sp.

TICHENKO (O. D.). **Emploi de préparations arsenicales dans la lutte contre les larves d'Anophélines.**—*Bull. Soc. Path. exot.*, xxi, no. 8, pp. 655–656. Paris, 1928.

Experiments were made with various soluble and insoluble arsenicals against Anopheline larvae. Arsenic trichloride, applied at the rate of 2 gm. to the square metre of water surface with road dust and rye bran as neutral carriers, killed all the larvae in 48 hours. The swelling particles of bran formed a sufficiently thick coating to keep the preparation on the surface of the water for some time. Copper arsenate at the rate of 0·1 gm. to 1 sq. m., with 2 gm. road dust, killed all larvae in 24 hours; iron arsenate at the same rate killed all larvae in 48 hours. Under natural conditions all larvae were killed in 48 hours when copper arsenate was used at the rate of 0·3 gm. to 1 sq. m., but iron arsenate was not effective. Experiments with sodium arsenate at the rate of 2 gm. to 1 sq. m. showed that the larvae were killed by the toxic action of the concentrated solution (1 gm. per 24,000 cu.cm.) and not as a result of ingesting particles of the poison. In spite of dusting this substance in a thin layer and using various neutral carriers, it was found impossible to keep it on the surface, because it dissolved in 15–20 minutes. Experiments under natural conditions showed that sodium arsenate is effective against Anopheline larvae in shallow enclosed waters.

KOBAYASHI (H.). **On the Animal Parasites in Chosen (Korea). Second Report.**—*Acta medicinalia in Keijo*, xi, fasc. 2, pp. 109–124, 40 refs. Keijo, Imp. Univ., 1928.

This paper summarises records of research published since the issue of the previous report [*R.A.E.*, B, xiii, 67], including statistics of the occurrence of malaria in Korea, where it appears to be decreasing in the south and increasing in the north of the peninsula. Collections

of mosquitos in an endemic region of malaria show that Anophelines are most prevalent from July to September. The most numerous species is *Anopheles hyrcanus* var. *sinensis*, Wied., which breeds in permanent waters where grasses and algae are growing, rice-fields being the most important breeding-places in Korea, though their occurrence does not correspond with the endemicity of the disease. A case of elephantiasis is recorded, associated with infestation by *Filaria bancrofti*. *Oedemagena tarandi*, L., is recorded as infesting the skin of *Capreolus bedfordi* and *Hydropotes argyropus*. The larvae are found under the skin of the hosts from January to April, when they enter the ground to pupate. It is supposed that the flies emerge in July or August.

Spencer (G. J.). **External Parasites on certain Birds of British Columbia.**—*Canad. Ent.*, lx, no. 11, pp. 257–260. Orillia, Ont., November 1928.

Notes are given on the ectoparasites found on five different species of birds. They include *Ornithomyia avicularia*, L., observed on *Cyanocitta stelleri*. Sixteen examples of the louse, *Degeeriella deficiens*, Piaget, were attached to this Hippoboscid [*cf. R.A.E.*, B, xv, 208; xvi, 234].

Sprehn (C.). **Die wichtigsten tierischen Parasiten unserer Pelztiere.** [The most important Animal Parasites of Fur-bearing Animals in Germany.]—*Deuts. tierärztl. Wschr.*, xxxvi, no. 46, pp. 763–767, 15 refs. Hanover, 17th November 1928.

A short account of the development of the breeding of animals for their fur in Germany is followed by a list of the animal parasites of the more important fur-bearing animals, fox, mink, marten, and rabbit. Fleas are important as possible intermediate hosts of tape-worms. The mange-producing mites include *Otodectes cynotis*, Hering, on foxes; *Psoroptes* and *Notoedrus* (*Notoedres*) *cati*, Hering, on rabbits; and *Acarus siro*, L., on foxes, martens and rabbits.

Murray-Jones (F.), McCallum (H.) & Newman (L. J.). **Lice and Tick in Sheep.**—*Bull. Dept. Agric. W. Aust.*, no. 153, 19 pp., 13 figs. Perth, 1925.

The first three sections of this bulletin have been previously noticed [*R.A.E.*, B, xiii, 102, 103]; the last section consists of extracts from regulations under "the Stock Diseases Act, 1895" providing for the compulsory dipping of sheep in certain areas and at certain periods against lice and *Melophagus ovinus*, L., and prohibiting the movement or sale, etc., of infested sheep.

Wardle (R. A.). **The Problems of Applied Entomology.**—Demy 8vo, xii + 587 pp., 4 pls., 29 figs. Manchester, The University Press, 1929. Price 30*s.* net.

The first part of this book (pp. 1–247), dealing with general problems, contains little of direct interest from a medical or veterinary standpoint, except for brief reviews of Roubaud's theories of zootropism in Anophelines and of hibernation and aestivation, and summaries of some

recent work on repellents for various Diptera, on the immunity of insects from bacterial disease, and on the toxicity to man and animals of plants sprayed with arsenicals.

The second part, which is on entirely original lines, presenting a review of all the more important insect problems of the world, includes in the account of each area a discussion of its medical and veterinary entomology. The author divides the world into areas, principally on an agricultural basis. In most cases, these areas have their own problems with regard to Arthropods and disease. In some, however, this treatment might lead to a false impression concerning the geographical distribution of a disease; for instance, no mention is made of malaria in the sections dealing with West, South and East Africa. The last two chapters of the second part, on "locality disinfection" and "locality protection," include discussions of mosquito control measures and barrier zones to prevent the spread of *Glossina*.

A bibliography, an index of authors cited and a subject index are included.

WARDLE (R. A.). **The Principles of Applied Zoology.**—Demy 8vo. xii+427pp., 56 figs. London, &c., Longmans, Green & Co., 1929, Price 21*s.* net.

In this book the author has attempted to provide a summary of the whole field of applied zoology that will be of value to students of agriculture, medicine or zoology, and to the general reader. The work is divided into four parts, the first devoted to medical and veterinary zoology, the second to agricultural and horticultural zoology and the third to animal industries; the fourth consists of a fairly extensive bibliography, classified by subjects, and an index.

Four chapters of the first part deal with Protozoa and four with Helminths, with special reference to pathogenic forms. The Arthropods injurious to man and animals are discussed in the remaining four chapters of this part, and are divided into four categories, those that inoculate a toxic substance into the tissues of the host, those that cause lesions by their presence in the tissues, those that transmit disease mechanically, and those that transmit disease cyclically. Injury caused by Arthropods of the first category, which includes those with venomous bites, stings or irritant hairs, the author terms "toxic inoculation." For injury caused by Arthropods of the second category, which includes certain Dipterous larvae, fleas and mites, the author uses the term "entomiasis." This term, he suggests, should be restricted to lesions caused by Arthropods that are known to attack invariably, or at any rate very frequently, the tissues of living animals, and in particular of healthy, unwounded animals, and which may be incapable of breeding in dead tissues.

ROBINSON (D. H.) & JARY (S. G.). **Agricultural Entomology.**—Cr. 8vo, xi+314 pp., 149 figs. London, Duckworth, 1929. Price 15*s.* net.

This elementary text-book, which is reviewed elsewhere [*R.A.E.*, A, xvii, 186], includes in the second part, which deals with the more important injurious and beneficial insects occurring in Britain, brief accounts of the lice, fleas and blood-sucking Diptera that attack man and domestic animals.

Poulton (W. F.). **Tsetse Fly and Trypanosomiasis.**—*Rep. Vet. Dept. Uganda 1926*, p. 6. Entebbe, 1927.

In Uganda outbreaks of trypanosomiasis in cattle occur far removed from any known tsetse-fly areas, and further investigation into the possibility of the existence of small foci of fly such as *Glossina pallidipes*, Aust. [*cf. R.A.E.*, B, xvi, 259], *G. brevipalpis*, Newst., and *G. fusca*, Wlk., is indicated, in conjunction with continued work on the part played by other blood-sucking flies as possible vectors of the disease. The view previously expressed that there is a diminution in the well-known fly belts [xiv, 184] has been substantiated. Though cattle were used to attract the flies during a tour of South Ankole, *G. morsitans*, Westw., was taken at one centre only.

Hall (G. N.). **Research Division Annual Report, 1926.**—*Rep. Vet. Dept. Uganda 1926*, pp. 12–16. Entebbe, 1927.

The author briefly discusses previous work on the mechanical transmission of trypanosomiasis by blood-sucking flies other than *Glossina* [*cf. R.A.E.*, B, xiv, 185]. An experiment was conducted to ascertain whether *Trypanosoma congolense* is readily transmitted in nature. A herd of five cattle was kept under observation for some weeks, but when an infected animal was introduced, two healthy oxen developed infection in 17 and 19 days respectively. Other experiments in which *Stomoxys* was first allowed to feed on beasts heavily infected with *T. congolense*, *T. vivax* and *T. brucei*, and then kept for various periods up to an hour before being permitted to feed on uninfected animals, all gave negative results. Similarly, transmission could not be effected when flies were half fed on an infected beast and immediately transferred to a healthy one to finish their feed, nor was it obtained when infected and uninfected cattle were exposed for six weeks to the attacks of large numbers of *Stomoxys* in a fly-proof stable [this result was subsequently confirmed—B, xvi, 260]. The systematic dissection of hundreds of *Stomoxys* has failed to reveal that any cycle of the trypanosome takes place in this fly.

Gordon (R. M.). **Report on a proposed Site for an Oil-palm Plantation at Mabang.**—*Ann. Med. San. Rep. Sierra Leone 1927*, pp. 72 79. Freetown, 1928.

During a month's survey of about 2,000 acres at Mabang, Sierra Leone, on which it is proposed to establish an oil-palm plantation, 232 individuals of *Glossina palpalis*, R.-D., and two of *G. fusca*, Wlk., were collected at five villages in or near the area, the majority being caught on the banks of a small river. No trypanosome infection was found in the salivary glands of dissected flies, or in any of the villagers examined, although the high proportion of gut infections, 12 out of 120 dissected, suggests that the area would be dangerous for cattle.

Ruttledge (W.). **Tsetse-fly** (*Glossina morsitans*) **in the Koalib Hills, Nuba Mountains Province, Sudan.**—*Bull. Ent. Res.*, xix, pt. 3, pp. 309–316, 2 pls., 1 map. London, December 1928.

An account is given of the bionomics of *Glossina morsitans*, Westw., in the Koalib Hills, Sudan, a small area that lies 200–300 miles north of any other locality where *G. morsitans* occurs. The fly is restricted at

all times of the year to the hills, where it was found to breed in the shade of rocks, and it is always closely associated with the Nuba inhabitants and their animals, even frequenting villages and their environs. The native cattle, goats and sheep are resistant to trypanosomiasis, though the pigs and dogs are susceptible; all these animals harbour trypanosomes, which have also been found in the salivary glands of the fly. Wild fauna is scarce in and near the area, and the fly is probably entirely dependent for food on the Nubas and their animals. An experiment in direct control in a small group of hills is described. A gang of ten boys equipped with fly-swatters was employed daily, and although it was found impossible to reduce the numbers of flies below a very low minimum, the method would be of use as a routine control in small areas. Experiments with fly lime (consisting of resin dissolved in castor oil by boiling) indicated that the shiny appearance of the lime deterred the flies from alighting upon it. Marked flies remained in the bush for 10–15 days during the rains, but eventually returned to the hills; it is suggested that, given a constant food-supply, many parts of the bush that are otherwise suitable might harbour the fly during the rains and early dry season.

DUKE (H. L.). **Immunological Studies of** *Trypanosoma gambiense* **and** *T. rhodesiense*.—*Parasitology*, xx, no. 4, pp. 427–447, 3 refs. Cambridge, December 1928.

In this paper the author gives further data on the transmissibility by *Glossina palpalis*, R.-D., of certain strains of *Trypanosoma gambiense* isolated from man and transmitted to animals [*R.A.E.*, B, xvii, 40], together with the results of attempts to produce superinfection of these animals by the bites of individuals of *G. palpalis* infected with homologous and heterologous strains of *T. gambiense*, with *T. rhodesiense* and with the Damba trypanosome.

The author considers that the behaviour of *T. gambiense* in the sheep and goats of these experiments is fairly consistent, and he suggests the occurrence of true immunity in these animals. In one sheep, the trypanosome remained transmissible for some time, but lost its transmissibility after a few months; later all signs of infection disappeared. Exposure 16 months after the original infection to the bites of tsetse-flies infected with the same strain of *T. gambiense* resulted in a transitory infection, but the strain was not transmissible in the sheep; four months later, an attempt to infect the animal with a different strain of *T. gambiense* produced no recognisable effect. In another sheep infected with *T. gambiense*, the trypanosome remained transmissible for at least 15 months, but caused no apparent symptoms in the animal; whether the trypanosome retained its infectivity for man during this period, and consequently whether the sheep can be regarded as a reservoir of human trypanosomiasis, is unknown. A third sheep, inoculated with *T. gambiense*, apparently acquired immunity from this trypanosome, as exposure to superinfection with a homologous strain had no effect. The animal, however, was readily susceptible to *T. rhodesiense*, and eventually died as the result of infection with this trypanosome. A goat that had been infected for a year with a non-transmissible strain of *T. gambiense* was not demonstrably affected when exposed to superinfection with a transmissible strain of this trypanosome, but two months later was found to possess no resistance to the Damba trypanosome. Several observations indicate that the forms of the

parasite suitable for development in *Glossina* are not as a rule present in the blood during the first few days after trypanosomes first appear in the peripheral circulation.

In a monkey infected with *T. gambiense*, the transmissibility of the trypanosome was high for the first five months, but had fallen to zero at the end of a year. Two months later the animal was reinfected with the same strain from another source, and a slight and temporary recrudescence of transmissibility occurred. Five months later (19 months after original infection), tsetse-flies infected with a heterologous strain of *T. gambiense* were allowed to feed on the monkey, and a considerable recrudescence of transmissibility occurred. During the whole of these experiments the monkey remained apparently in perfect health.

The author suggests that the processes observed in this monkey, which apparently developed no permanent immunity, but a condition of tolerance in which each new introduction of *T. gambiense* was accompanied by a temporary recrudescence of transmissibility, may also occur in man. It must be supposed that more or less resistant human cases, whose strains have become non-transmissible, will again become infectious when bitten by an infective fly, and can thus serve as a reservoir of the trypanosome, enabling it to persist more or less sporadically, in a transmissible form, until conditions favourable to its spread occur.

The following is taken from the author's provisional conclusions: Natural immunity against *T. gambiense*, as exhibited by sheep and goats, varies from complete immunity to a degree of susceptibility in which the trypanosome may be a contributory or even, possibly, the direct cause of death. Between these extremes is found a peculiar partial immunity that operates solely on the transmissibility of the trypanosome by *G. palpalis*, abolishing this property but leaving the strain still capable of producing gut infections in tsetse-flies and still demonstrable in the peripheral blood. The development of immunity may be arrested at this stage for a considerable time, or it may continue until the animal is both sterilised of an existing infection and immunised against subsequent infection with the same species of trypanosome. Once established, absolute immunity may persist for at least six months. When once the first stage of immunisation is reached by an animal, all strains of the same species subsequently introduced into its blood will produce non-transmissible infections. Monkeys are much more susceptible to the pathogenic action of *T. gambiense* than are ruminants; so also is man. It is very seldom that a monkey survives infection with *T. gambiense* as one in these experiments did, but in man many instances are known of prolonged survival after infection by this trypanosome.

MORISHITA (K.). **A Flagellate Parasite of *Triatoma rubrofasciata* (Hemiptera, Heteroptera) and the Trypanosome developing from it in Laboratory Animals.** [*In Japanese.*]—*Med. J. Formosa*, no. 285, pp. 1–7. Taihoku, Formosa, December 1928. (With a Summary in English.)

The Reduviid, *Triatoma rubrofasciata*, DeG., sometimes attacks man in Formosa. Of the individuals captured in houses, all the females and 78·5 per cent. of the males were found to harbour a flagellate, which represents the developmental stage of a trypanosome of certain vertebrates. This trypanosome is not pathogenic to mice.

Bunau-Varilla (P.). **La Verdunisation dans la lutte contre la fièvre jaune.**—*C.R. Acad. Sci. Fr.*, clxxxvii, no. 22, pp. 1005–1006. Paris, 1928.

As *Aëdes* (*Stegomyia*) [*argenteus*, Poir.] seems unable to develop in water that does not contain organic matter and micro-organisms [*R.A.E.*, B, xv, 161], the purification of water by treating it with 1 gm. chlorine to 10 cu. m. would appear to be a valuable measure against yellow fever, if the distribution of the water is properly carried out and it is not allowed to become stagnant in cisterns in dwellings. In support of this view it is remarked that at Dakar the disappearance of yellow fever coincided with the distribution of water so treated in June 1928.

Blanc (G.) & Caminopetros (J.). **Expériences faites en Grèce sur le mode de transmission de la "dengue."**—*C.R. Acad. Sci. Fr.*, clxxxvii, no. 23, pp. 1081–1083, 1 ref. Paris, 1928.

During the recent outbreak of dengue at Athens, examples of *Aëdes argenteus*, Poir. (*Stegomyia fasciata*, F.) that had fed on an infected person, or had been taken from a room occupied by patients, were removed to an island to the east of Crete where the disease does not occur. There, 8 days after being collected, they were crushed and injected under the skin of 3 volunteers, who developed the disease after 7, 8 and 9 days, respectively. A similar successful experiment was made with mosquitos fed 4 days before on an infected person. Further experiments showed that mosquitos fed on an infected person transmit the fever by biting 9 days after feeding and remain infective for 28 days. The authors were unable to obtain transmission of the fever by means of the bites of *Culex*.

Burnet (E.), Durand (P.) & Olmer (D.). **Essais de transmission de la fièvre exanthématique de Marseille par les poux.**—*C.R. Acad. Sci. Fr.*, clxxxvii, no. 23, pp. 1084–1085. Paris, 1928.

In connection with attempts to find parallels between Marseilles fever and typhus, lice, *Pediculus humanus*, L. (*vestimenti*, Nitz.), obtained from the endemic region of Marseilles fever, were fed on monkeys experimentally infected with the disease, and then crushed and injected under the skin of healthy monkeys and of two men. In no instance was infection obtained.

Nicolle (C.), Anderson (C.) & Colas-Belcour (J.). **Adaptation experimentale de spirochètes récurrents à des ornithodores autres que ceux qui les transmettent dans la nature.**—*C.R. Acad. Sci. Fr.*, clxxxvii, no. 24, pp. 1105–1107. Paris, 1928.

Each relapsing fever spirochaete of the group that is transmitted by species of *Ornithodorus* is naturally associated with a single species of tick, with a few minor exceptions. Experimentally, however, spirochaetes are transmitted by any tick. The authors have obtained transmission by *O. moubata*, Murr., and by *O. savignyi*, Aud., of *Spirochaeta duttoni* and its Dakar form (*S. crocidurae*), *S. hispanica*, *S. hispanica*

var. *marocana*, *S. sogdiana* and *S. normandi* ; by *O. marocanus*, Velu, of all except the last ; and by *O. normandi*, Larr., of *S. normandi*, and its Carthaginian variety [*R.A.E.*, B, xvi, 160], *S. duttoni* and *S. sogdiana*. Transmission was obtained by the bites of the ticks in each case. The conditions necessary for transmission are that nymphs must be used (adults acquire infection but cannot transmit the spirochaetes by their bites) and these must have fed on a heavily infected animal. *S. gondii* is very rare in the animals it infects, and the authors were unable to adapt it to any of the ticks tried, *O. moubata*, *O. savignyi* and *O. marocanus*.

In every case where the experiment was followed long enough, hereditary transmission in the ticks was observed, prolonged to several generations in the case of the natural vector of the spirochaete, but not so long in the case of other ticks.

The authors conclude from their experiments that the natural bond between a tick-borne spirochaete and its vector is entirely geographical.

HAMLYN-HARRIS (R.). **Notes on the Breeding-habits of *Culex fatigans* Wied., and its associated Mosquitoes in Queensland.**—*Proc. Roy. Soc. Qd.*, xl, no. 8, pp. 91–103, 2 pls., 11 refs. Brisbane, 26th November 1928.

The following is largely taken from the author's summary. *Culex fatigans*, Wied., is found associated with no less than 9 different species of mosquitos in Greater Brisbane, where it is the commonest night-feeding Culicid. The association depends to a large extent upon the state of the water at the time of oviposition, the hydrogen-ion concentration, within certain limits, serving only as an indication of the type of water preferred by the various organisms used as food by the larvae. The considerable mortality that occurs at all times, but especially during hot weather, among the developmental stages of *C. fatigans* is due either to the toxic nature of the products of decomposition of the water contents, especially induced by a high temperature, or to a kind of narcotic poisoning probably caused by the carbon dioxide evolved. *C. fatigans* and *Aëdes notoscriptus*, Skuse, make full use of artificial receptacles in cemeteries, but *A. argenteus*, Poir., prefers vessels near human habitations [*cf. R.A.E.*, B, xv, 164]. Certain Charophyta do not thrive in polluted water, and when mosquito larvae occur with *Nitella*, it is usually in association with *Anopheles annulipes*, Wlk., and other sylvan species rather than with *C. fatigans* [*cf.* B, xvi, 202]. Under laboratory conditions, however, the latter often lays egg-rafts on water containing this plant, though *A. argenteus* seems selectively to do so more frequently. The males of *C. fatigans* develop first, and whereas the presence of food is a determining factor in the selection of its breeding-places, the ability of the water to preserve the supplies in a perfect state seems to be of more importance in determining the rate of development. Experiments proved that the vitality of the larvae was in direct proportion to the concentration of decomposition products in the water. The possibilities of septic tanks as breeding-places must be recognised in an active anti-mosquito campaign, and the screening of pipes connected with their exterior should be insisted upon. Surveys of tanneries also revealed other favourable breeding-places.

BRUG (S. L.). **Notes on the Mosquitoes collected by the New Guinea Expedition in 1926.**—*Nova Guinea*, xv, Zool., livr. 3, pp. 357–359, 1 fig. Leyden, December 1927.

Among the mosquitos collected in New Guinea are the following Anophelines: *Anopheles* (*Nyssorhynchus*) *punctulatus*, Dön., *A.* (*N.*) *punctulatus* var. *moluccensis*, Swell., *A.* (*N.*) *annulipes*, Wlk., and transitional forms between the typical *A. punctulatus* and its var. *moluccensis*.

MANALANG (C.). **Notes on Malaria Transmission.**—*Philipp. J. Sci.*, xxxvii, no. 1, pp. 123–132, 4 pls., 4 refs. Manila, September 1928.

In a survey of 69 malarious places in the Philippine Islands *Anopheles minimus*, Theo., a stream breeder, was found in 93 per cent., and was the predominant species in 77 per cent. of the localities examined. In a further survey of 25 localities, *A. minimus* was consistently found, alone or with other species, in each of the 11 places proving malarious; while when *A. minimus* or its potential breeding-places were absent, and other Anophelines present or abundant, there was invariably no malaria. Dissections of mosquitos taken in the second worst malaria district from September to December 1927 showed no trace of infection in any of the other species examined, *viz.*, *A. hyrcanus*, Pall., *A. barbirostris*, Wulp, *A. subpictus*, Grassi (*rossi*, Giles), *A. karwari*, James, *A. tessellatus*, Theo., *A. fuliginosus*, Giles, *A. philippinensis*, Ludl., and *A. maculatus*, Theo., whereas 0·83 per cent. of *A. minimus* contained oocysts and 0·35 per cent. sporozoites. It is therefore assumed that *A. minimus* is the natural vector of malaria in the Philippines, and while it is possible that other species may, in certain localities, also transmit the disease under natural conditions, this requires to be proved by further observations [*cf. R.A.E.*, B, xvi, 6]. The method followed in the dissection of the mosquitos is described in detail. Microphotographs are presented, particularly those of the sporozoites, to compare with those of *A. ludlowi*, Theo., given by Banks, who, in 1907, claimed to have produced artificial malaria infection in the latter mosquito. A comparison between a photograph of the thoracic ganglion of *Culex* and one of Banks' plates suggests that Banks mistook the nuclei of the neurones for sporozoites.

The results of these investigations are considered to justify limiting larval control by the application of Paris green and road dust to streams and irrigation ditches in which *A. minimus* breeds, and to indicate that engineering projects are unnecessary against malaria in the Philippines. As *A. minimus* is typically wild and seldom found in houses even at night, a campaign against the adults is impracticable. Most of the 2,700 specimens caught, of which only two were males, were taken in the evening outside houses by exposure of the body or limbs of the collectors. In localities with permanent streams, the peak of the malaria season has been observed to coincide with the dry season (rice harvest) and with the abundance of breeding of *A. minimus*, when the water is clear and at a constant level. The lower malaria incidence, coinciding with the rainy season, is due to the carrying away of the larvae by flooding. Where the malaria season starts after the rain and decreases during the dry season, it has been observed that breeding-places of *A. minimus* have been formed by temporary streams that dry up in the dry season. In one locality, where both sets of conditions exist, cases of malaria occur in both dry and rainy seasons.

Edwards (F. W.). **The Nematocerous Diptera of Corsica.**—*Encyc. ent.*, Sér. B, II. Dipt., iv, fasc. 3–4, pp. 157–189, 6 figs., 15 refs. Paris, 1928.

Among the Diptera dealt with in this paper, a list is given of 32 mosquitos occurring in Corsica, including the Anophelines, *Anopheles maculipennis*, Mg., *A. sacharovi*, Favr, *A. bifurcatus*, L., *A. algeriensis*, Theo., *A. hyrcanus*, Pall., and *A. plumbeus* var. *corsicanus*, n., as well as *Aëdes argenteus*, Poir.

Smorodinzev (I. A.), Sebenzov (B. M.) & Adova (A. N.). **Les variations de la réaction réelle de réservoirs d'eau artificiels dans les recherches sur la biologie des Anophèles.**—*C.R. Soc. Biol.*, xcix, no. 36, pp. 1763–1769, 3 refs. Paris, 14th December 1928.

Previous studies near Moscow having shown that acid sphagnum waters, poor in calcium, and with a relatively high iron content, are detrimental to the development of Anopheline larvae [*Anopheles maculipennis*, Mg.], while these larvae thrive in the more alkaline sedge waters [*cf. R.A.E.*, B, xvi, 218; xvii, 7], further studies were carried out in order to determine to what extent the action of the surroundings was responsible for the influence exercised, and what precise chemical conditions were unfavourable to the development of the larvae. Observations were made in eight artificial reservoirs, three of which contained respectively sphagnum, sedge and ordinary water, certain proportions of various chemicals being added to the remainder. All the larvae in the sphagnum water died in 2–3 days, and the best results were secured in water with either high or low artificial calcium content, the results with the sedge water being unexpectedly poor. The results of the observations as regards calcium and iron are inconclusive, but the larvae died in waters with a low pH. During the first 5 weeks the pH value remained fairly constant in the highly acid waters (2·49–2·71) and fell from 6·70 to 5·62 in the more nearly neutral waters, a progressive increase in acidity occurring subsequently in all the reservoirs.

Wigglesworth (V. B.). **Delayed Metamorphosis in a Predaceous Mosquito Larva and a possible practical Application.**—*Nature*, cxxiii, no. 3088, p. 17. London, 5th January 1929.

The author records that a young larva of *Megarhinus* (*Toxorhynchites*) *brevipalpis*, Theo., found in a rot-hole in a tree in Southern Nigeria, was brought to England in 2 or 3 ounces of its natural water, with an occasional larva of *Aëdes*, and kept at 24° C. (75·2° F.) without any special attention for 5 months. In view of the project for introducing this mosquito into the South Pacific Islands as a means of controlling *Aëdes variegatus*, Dol., and the supposed difficulty of transporting it for some 3,000 miles, this record is valuable as suggesting that by simply limiting the food-supply, the larval stage can be prolonged by at least five months.

Williams (L. L.) & Legare (A. E.). **Length of Life of *Anopheles quadrimaculatus* after beginning of Control of Production.**—*Southern Med. J.*, xxi, no. 9, pp. 735 737. Birmingham, Ala., September 1928.

Reproduction in Anophelines begins long before temperature and other conditions are suitable for the transmission of malaria, and where

larvicides are used as a measure for the prevention of the disease, much material may be wasted in destroying early broods. In many areas malarial infection in the mosquito does not develop before late June or early July, whereas Anophelines emerge throughout April, May and June. Observations were therefore made in Virginia and South Carolina to determine the interval that must elapse between the first application of larvicides and the practical disappearance of adult mosquitos.

Adults of *Anopheles quadrimaculatus*, Say, disappeared within 10–14 days after the larvae in neighbouring breeding-places had been destroyed. Where control measures were discontinued, adults reappeared within 14–21 days after the last application of the larvicide. A similar observation on *A. punctipennis*, Say, showed that the adults disappeared in 12 days. These results indicate that measures against the larvae need not be begun more than 10 days before control of the adults is necessary, and that at the end of the season larvicides need not be applied later than 2–3 weeks before the date when control of the adults is no longer necessary.

BARBER (M. A.). **Malaria Survey in Irrigated Regions of Rio Grande River, New Mexico.**—*Southern Med. J.*, xxi, no. 9, pp. 737–738. Birmingham, Ala., September 1928.

During the summers of 1926 and 1927, surveys were made of two regions in New Mexico, one in the north at an altitude of 5,600 ft. above sea-level, and the other in the south at 3,800 ft. In the former, malaria has been endemic for many years, only the benign tertian type being present. In the latter malaria has increased considerably during the last three years, both benign and malignant tertian being found. In both regions *Anopheles* [*pseudopunctipennis*, Theo., and *maculipennis*, Mg.] are very abundant. In the northern region the chief breeding-places are the ancient beds of the Rio Grande and wet pastures supplied with water from irrigation ditches, and in the southern regions the drainage ditches. In the first case drainage, of a comparatively inexpensive type, would effect a great reduction in breeding-places, and in the second the removal of aquatic vegetation would doubtless be effective, though very expensive and at best a temporary measure. The use of Paris green would be feasible in all the breeding-places along the Rio Grande in New Mexico. Two species of *Gambusia* were introduced in 1927, and one had begun to multiply by September.

COOK (S. S.) & WILLIAMS (L. L.). **Airplanes and Paris Green in Control of *Anopheles* Production.**—*Southern Med. J.*, xxi, no. 9, pp. 754–759, 3 figs., 4 charts, 6 refs. Birmingham, Ala., September 1928.

An account is given of further experiments in Virginia on the distribution of Paris green from aeroplanes against larvae of *Anopheles quadrimaculatus*, Say [*cf. R.A.E.*, B, xv, 94] to determine the dilution of the dust, the quantity of Paris green to the acre, the number of applications during the season and the ability to treat areas covered by dense vegetation.

Dilutions of 25, 28, 33 and 50 per cent. by weight of Paris green in powdered soapstone were tested and, on the whole, 33 per cent. was found to be the most nearly satisfactory for all conditions. This dilution was sufficiently great to give excellent distribution in an almost

dead calm when the aeroplane was flying at a height of 150–200 ft. The same dilution gave equally good distribution in 10 and 12 mile breezes when it was flying 25–40 ft. above the surface of the water. Further experiments confirmed last year's conclusions that 1 lb. Paris green to the acre is the most effective rate. Suitable intervals between dusting varied with the season; at Quantico they ranged from 6 to 13 days. A further experiment was made to test the penetration of the dust through vegetation. Pans of larvae with glass slides nearby were placed at intervals of 25 ft. in a swamp covered with dense vegetation. Approximately 1 lb. Paris green to the acre was applied by aeroplane, and four hours later the mortality in the pans was practically 100 per cent. The slides showed 28–69 particles of Paris green to the square inch, and more Paris green was observed on the water itself than on any part of the vegetation examined.

Practically any type of aeroplane is suitable for distributing Paris green, and a simple box with sloping sides may be used as a hopper. Details are given of the hopper actually constructed, and of the cost of the material, labour, aeroplanes, etc. Approximately 364 acres were dusted in an hour, and it is estimated that one aeroplane could deal with 20 square miles of breeding surface. The cost of Paris green and soapstone worked out at approximately 3*s.* an acre for the season.

Herms (W. B.). **Limitations in the Use of Top Minnows in *Anopheles* Mosquito control in California and Observations on Anopheline Flight Activities.** *Southern Med. J.*, xxi, no. 9, pp. 761–762. Birmingham, Ala., September 1928.

In a large precentage of Anopheline breeding-places in California, it is difficult to maintain effective control by means of *Gambusia*, on account of winter floods that carry away the minnows. The pools left by the receding streams are prolific sources of Anophelines. Arrangements are being made in one locality to keep several thousand minnows in a concrete tank during the winter for repopulating streams after the winter floods.

Anophelines do not usually fly far from their breeding-places, but in California two definite migrations take place, the first in February and the second at the close of the breeding season in late September and early October. Males do not participate in these flights, which are probably made to secure the dispersal of the species.

Komp (W. H. W.). **A successful Method of rearing Anopheles Larvae.** – *Southern Med. J.*, xxi, no. 9, pp. 760–761, 4 refs. Birmingham, Ala., September 1928.

Anopheline larvae are surface feeders almost exclusively when there is sufficient scum to afford them nourishment, and in nature this is almost always the case. A method that has been successfully used for a number of years in the rearing of adult Anophelines from eggs and larvae is described. A mass of green algae (*Spirogyra*) is heated sufficiently to kill it; it is then placed in a tall battery-jar that is subsequently filled to the top with tap-water. In 24 hours a thin scum forms, composed of algae, infusoria and protozoa of various kinds. This scum is removed and placed on the surface of the water in ordinary china cups containing the larvae, thin scums being used to feed the smaller larvae, and thick scums in large quantities for the larger ones. There is apparently no limit to the number of larvae that may be placed

in a cup if sufficient food is provided. At high temperatures the larvae are very voracious, and it is often necessary to feed them two or three times a day if adults are to be obtained in the shortest possible time. Otherwise one feeding a day, preferably in the morning, is sufficient. As pupation occurs, lamp-chimneys, with one end closed with mosquito netting, are placed over the cups to retain the adults as they emerge. The advantage of this method is that by using clean water and supplying only as much scum as the larvae will consume, contamination of the water is prevented to a large extent, with a consequent lessening in the mortality of the larvae.

KING (W. V.). **The *Anopheles* Density Index in Malaria Research and Control Work.**—*Southern Med. J.*, xxi, no. 9, pp. 763–767, 3 charts, 6 refs. Birmingham, Ala., September 1928.

The author points out the advantage of using a density index as a means of standardising the records of mosquito incidence and of enabling comparisons to be made of the abundance of Anophelines in different local areas, at different periods, or in relation to the incidence of malaria.

Anopheles quadrimaculatus, Say, is generally considered to be the principal vector of malaria in the United States, and the varied conditions under which it occurs in different localities may possibly make the problem of measuring density on a comparable basis difficult, but since it may be feasible in many rural communities, the author discusses the method used in obtaining various indices in Louisiana. In order to secure greater uniformity of density records in rural communities, it is suggested that a sufficient number of preliminary collections should be made in each locality to determine the principal resting places, the approximate total abundance of Anophelines, and the proportion in each general type of shelter, and that, if one type of resting place is to be selected for the density index, it should be one of the principal resting places and should be reasonably uniform at the various dwellings or stations where counts or collections are to be made.

GRIFFITTS (T. H. D.). **Salt Marsh Mosquitoes: Some Phases of the Problem in the United States.**—*Southern Med. J.*, xxi, no. 9, pp. 767–769. Birmingham, Ala., September 1928.

The economic loss caused by mosquitos that are not vectors of disease is discussed. The importance of salt marsh mosquitos in this respect has been recognised by the United States Congress, which appropriated about £5,000 in 1927 and an additional £5,000 in 1928 for a preliminary survey of the South Atlantic and Gulf States to determine the exact character of the breeding-places of the salt marsh mosquitos and the best methods of controlling them. The area covered by salt marshes in these States is enormous, but the survey has shown that they vary greatly in character and that relatively few of them constitute actual or even potential breeding-places. The lines on which the survey has been carried out are briefly described.

The most important of the salt marsh mosquitos is *Aëdes sollicitans*, Wlk., which is also the chief species taking part in the long distance migration flights that occur inland from the salt marshes. The next in importance is *A. taeniorhynchus*, Wied., which does not appear to be

capable of such sustained flight as *A. sollicitans*, and the third is *Culex salinarius*, Coq. *Anopheles crucians*, Wied., breeds in fresh water and in salt water, sometimes of a higher degree of salinity than sea water, and occurs generally in the salt marshes of the South Atlantic and Gulf States, sometimes outnumbering and biting more generally than the Culicines. *Anopheles atropos*, D. & K. [*R.A.E.*, B, xvi, 33], is also a virulent biter and at times occurs in large numbers near its breeding grounds. The species of *Aëdes* found in salt marshes lay their eggs on the marsh soil, depositing them continuously for months even during a drought. When the drought is broken by rains or the marsh is flooded by unusually high tides, the eggs begin to hatch within an hour and give rise to enormous numbers of mosquitos. Flight may then take place merely as a dispersal, or with a prevailing breeze (but not a strong wind) and proper temperature and humidity, a migration flight may occur, extending in some instances 30–40 miles inland. Various methods of control are being studied, including gravity drainage, the making of dykes, pumping, filling, and the application of poisons against the larvae either from aeroplanes or by means of land machines.

Fraga (C.). **The Yellow Fever Epidemic at Rio de Janeiro.**—*Publ. Hlth. Rep.*, xliii, no. 47, pp. 3079–3083. Washington, D.C., 23rd November 1928.

From 1908 onwards, following the campaign of Oswaldo Cruz, Rio de Janeiro was free from yellow fever until 1928, when the disease again appeared, having probably been introduced by soldiers newly arrived from the northern States. The clinical nature of the disease is discussed. Anti-mosquito measures were energetically undertaken, including the destruction of the adults in houses by spraying and by fumigation with sulphur or pyrethrum. Of the sprays tried, the best was a mixture of kerosene oil containing 3·5 per cent. of pure carbon tetrachloride and 0·1 per cent. of methyl salicylate. It was applied with painters' spraying machines, operated by electric motors using compressed air, and by this means whole blocks of the city were systematically treated. These measures, together with the control of breeding-places, were successful in almost eliminating the mosquitos, and it is hoped that the fever will be entirely exterminated in Rio.

Maxcy (K. F.). **The Distribution of endemic Typhus (Brill's Disease) in the United States.**—*Publ. Hlth. Rep.*, xliii, no. 47, pp. 3084–3095, 2 maps, 30 refs. Washington, D.C., 23rd November 1928.

Information regarding the distribution of Brill's disease [*R.A.E.*, B, xv, 51] in the United States is somewhat fragmentary, but an attempt is made in this paper to outline its geographical limits, which are shown in a map illustrating approximately the towns from which the disease has been reported since 1915. Another map shows the result of a more intensive survey of the disease in Alabama during the last five years. A consideration of the latter reveals rather striking features. While Montgomery can be considered to be a primary focus, the disease has not spread along all the six railroads or the many highways that enter the city, cases having been confined almost entirely to the Atlantic coast line. It is obvious that the disease is dependent upon undetermined conditions that are present in these towns, and absent from those farther north in the State. Body lice [*Pediculus humanus*, L.] are almost unknown in Alabama, and infestation by head

lice [*P. capitis*, DeG.] among school children is less than 1 per cent. The general geographical limits of the disease do not seem to be satisfactorily explained on the basis of direct transmission from one person to another or by means of lice ; some other agency appears to be responsible for its preservation.

Les faunes régionales des rongeurs et des puces dans leurs rapports avec la peste. Resultats de l'enquête du comité permanent de l'Office International d'Hygiène publique 1924-1927.—Roy. 8vo, 306 pp., 10 pls., 7 figs. Paris, Masson et Cie, 1928.

The first part of this work, which is sub-divided into two main sections, consists of a general report by R. Jorge on the results of an enquiry carried out from 1924 to 1927 in regard to the agency of rodents and fleas in the conservation and transmission of plague. The pandemic form of plague associated with domestic rodents is distinguished from the form prevalent in uncultivated areas and occurring in wild rodents, and notes are given on the known types of rats that harbour the disease and their ectoparasites. Centres of the form of plague in uncultivated areas are classified geographically as African, European, Asiatic and American, and associated respectively with the gerbille (*Tatera lobengulae*), ground-squirrels (*Citellus* spp.), *Marmota* (*Arctomys*) *bobak*, and *Citellus beecheyi*. Semi-domestic rodents, which become intermediaries of infection for man owing to their occasional contact with human habitations, are various species of field mice and sometimes the domestic mouse. The transmission of the disease among animals and from animals to man is chiefly effected by means of fleas such as *Oropsylla* (*Ceratophyllus*) *silantiewi*, Wagn., *C. tesquorum*, Wagn., *Neopsylla setosa*, Wagn., *C. acutus*, Baker, *Dinopsyllus lypusus*, J. & R., *Chiastopsylla rossi*, Wtrstn., and *Xenopsylla eridos*, Roths., each rodent having one or more species definitely associated with it and any of these being equally capable of biting man. These fleas are able to conserve the bacillus for months at a time, even when unfed, and are liable to become reservoirs of the disease. Certain peculiarities of plague among wild rodents are pointed out. Human plague originating from this source, although generally following the normal course, is often associated with the pneumonic form, particularly in Manchuria.

Individual reports made by numerous different authors in connection with this enquiry are appended from 23 countries representative of all parts of the world where plague is known to occur.

The second part of this work consists of a descriptive study by E. Roubaud of the principal types of fleas attacking rodents associated with plague, which includes keys to the families, genera and species dealt with. In the case of the genus *Xenopsylla* and the more important group of species belonging to it, keys are given to both sexes. The chief characteristics and distribution of the more important species are discussed.

GALLAGHER (B. A.). **Special Report on Horn Fly Experiment.**—*Hawaii. For. & Agric.*, XXV, no. 3, pp. 144–146. Honolulu, 1928.

A brief account is given of unsuccessful experiments made during 1928, in which various substances were placed in the drinking water of cattle with the object of rendering their dung unsuitable for the development of the larval stage of the horn fly [*Lyperosia irritans*, L.].

Wilhelmi (J.) & Saling (T.). **Stand und Aufgaben der Simuliidenforschung.** [Position and Problems of Simuliid Investigation.] — *Z. wiss. Zool.*, cxxxii, pp. 329-354, 6 pp. refs. Leipzig, September 1928.

This paper reviews the present state of knowledge of Simuliids, chiefly in consequence of the investigations that were officially undertaken in Germany as a result of outbreaks involving losses of cattle in that country. All aspects of the question are discussed, with references to the literature, a full bibliography being given. The chief causes of outbreaks are the presence of large numbers of cattle, water flowing for long periods, at least in winter, at a rate of not less than 1 ft. a second, and sudden rise of temperature, which causes a mass emergence of Simuliids. Losses also occur where the cattle are not accustomed to the poison injected with their bites.

Cattle may be protected by covers or repellents, such as tar, or they may be kept away from pastures. Sometimes they are put out to pasture very early in order that they may be rendered resistant to further attacks by the bites of the few Simuliids present, but this may prove extremely dangerous, since one or two warm days may give rise to a mass emergence. No reliance can be placed on natural enemies of Simuliids. Clearing the streams of vegetation in late autumn may reduce the winter generation.

Cory (E. N.). **The Protection of Cattle from Flies.** — *Bull. Maryland Agric. Expt. Sta.*, no. 298, pp. 195–196. College Park, Md., July 1928.

Further tests were made during 1926 and 1927 for the protection of cattle from flies (*R.A.E.*, B, v, 73). Tests showed that a 4 or 5 per cent. emulsion of pine oil is necessary to repel flies for any considerable length of time. These emulsions alone are not sufficiently effective in killing the flies, but the addition of a proprietary pyrethrum spray, 1 : 500, in a 3 per cent. pine oil emulsion increased the killing efficiency of the latter, so that, whereas flies thoroughly wetted with the pine oil emulsion alone died in 2-3 minutes, a slight wetting with the mixture killed them in less than 2 minutes. No injury resulted to the cattle from these sprays. In 1927, soap was used as an emulsifier for the pine oils instead of sodium hydroxide and proved more satisfactory. It was found that 9 cows could be treated 14 times with 2 U.S. gals. spray. In cage tests 10 per cent. of the flies recovered when the pyrethrum was used at a dilution of 1 : 200, but all but 4 per cent. were killed when it was used at 1 : 100.

McHardy (J. W.). **Report by the Entomologist, Medical and Sanitary Services, Tanganyika Territory.** *Rep. Med. Lab. Dar-es-Salaam 1927*, pp. 13–29, 4 refs. London, 1928.

This report supplements the previous one (*R.A.E.*, B, xvi, 115), in conjunction with which it should be studied. In addition to the results of a further mosquito survey in the town and neighbourhood of Dar-es-Salaam, an account is given of the collection and dissection of *Anopheles funestus*, Giles, and *A. gambiae*, Giles (*costalis*, Theo.), from which it is concluded that both these species are very susceptible to malaria infection, are prone to enter houses and bite man, and are probably confined to dwellings in the neighbourhood of their breeding grounds except

during the periods when they are most numerous, when they penetrate to the central parts of the town. The small number of Anophelines caught, however, diminishes the value of the results secured.

Investigation of crab-holes indicates that these do not constitute a source of danger in Dar-es-Salaam, the only species numerous in them being *Aëdes pembaensis*, Theo.

The examination of blood films from native children, nearly all of whom proved to be infected with malaria, failed to indicate any marked variation in the local distribution of infection. In children over 1½ years old an immunity appears to develop to such a stage that the incidence gradually subsides. This subsidence seems to be due to a decrease in the incidence of *Plasmodium falciparum*, that of *P. malariae* and *P. vivax* remaining unchanged. Investigations in Mpwapwa to determine the presence of vectors of malaria resulted in the discovery of many Anophelines, all provisionally identified as *A. pitchfordi*, Giles. The adults did not enter dwellings at the time of the investigation.

Fleas taken from rats sent in during 1927, all of which were *Mus* (*Rattus*) *rattus* with the exception of two *M. norvegicus*, included numbers of *Xenopsylla brasiliensis*, Baker, and *X. cheopis*, Roths., and one female of *Ctenocephalus felis*, Bch.

Papers noticed by Title only.

[Wagner (J.).] **Вагнер (Ю. Н.). Ueber neue palaearktische Floh-Arten (Aphaniptera). I.** [New palearctic Species of Fleas. I.] —*Annu. Mus. zool.*, xxx, pt. 1, pp. 21–33, 15 figs. Leningrad, 1929.

Holmquist (A. M.). **Notes on the Biology of the Muscid Fly,** *Pyrellia serena* **Meigen, with special Reference to its Hibernation.**—*Ann. Ent. Soc. Amer.*, xxi, no. 4, pp. 660–667, 13 refs. Columbus, Ohio, December 1928.

Séguy (E.). **Etudes sur les mouches parasites et les formes voisines. Contribution à la connaissance des Chrysomyiini typiques. I. Les Chrysomyiini inférieurs et les** *Compsomyia* **du groupe** *albiceps*. **II. Les espéces typiques des genres** *Somomyia* **et** *Pycnosoma*.—*Encyc. ent.*, Sér. B, II. Dipt., iv, fasc. 1–2, pp. 1–14, 15 figs.; fasc. 3–4, pp. 101–116, 1 pl., 20 figs., 10 refs. Paris, 1927 & 1928.

Séguy (E.). **Caractères particuliers du** *Rhynchoestrus weissi*. [Adult Female and first stage Larva.]—*Encyc. ent.*, Sér. B, II. Dipt., iv, fasc. 3–4, pp. 97–101, 4 figs., 5 refs. Paris, 1928.

Connal (S. L. M. S.). **A Note on the Larva and Pupa of** *Tacniorhynchus* (*Mansonioides*) *africanus* **(Dipt., Culicidae).**—*Bull. Ent. Res.*, xix, pt. 3, p. 293, 1 pl. London, December 1928.

Morgan (A. C.) & Crumb (S. E.). **Notes on the Chemotropic Responses of certain Insects.**—*J. Econ. Ent.*, xxi, no. 6, pp. 913–920, 3 refs. Geneva, N.Y., December 1928. [*Cf. R.A.E.*, B, vi, 67; x, 83, 134; xii, 147.]

Horn (W.) & Schenkling (S.). **Index Litteraturae Entomologicae. Serie I: Die Welt-Literatur über die gesamte Entomologie bis inklusive 1863. Bände I-IV.**—8vo, xxi+1426 pp., 4 pls. Berlin-Dahlem, Dr. W. Horn, 1928–29. Price *Mk.* 75.

Aragão (H. de Beaurepaire). **Ueber *Phytomonas françai* (einen neuen Flagellaten des Milchsaftes von *Manihot palmata*).** [*P. françai*, a new Flagellate of the Latex of *M. palmata*.]—*Abh. Gebiete Auslandsk. Hamburg. Univ.*, xxvi, Ser. D. (Med.), ii (Festschr. Nocht), pp. 1–3, 1 pl. Hamburg, 1927.

Phytomonas françai, sp. n., has been found in the latex of *Manihot palmata* in Brazil. Transmission experiments to healthy plants by means of various Heteroptera were not successful, neither did the subcutaneous injections of the infected latex produce any pathological symptoms in laboratory animals.

Bentmann (E.). **Gibt es noch autochthone Malaria im Rheintal?** [Does indigenous Malaria exist in the Rhine Valley?]—*Abh. Gebiete Auslandsk. Hamburg. Univ.*, xxvi, Ser. D. (Med.), ii (Festschr. Nocht), pp. 25–36, 12 refs. Hamburg, 1927.

Though the Rhine Valley cannot be considered an endemic centre of malaria, sporadic cases occur there with some frequency, and the importance of exterminating all local foci by judicious treatment of infected persons and especially by protecting them from mosquito bites is pointed out.

Hoffmann (C. C.). **Zur Kenntnis der Anophelen Mexikos.** [On the Anophelines of Mexico.] *Abh. Gebiete Auslandsk. Hamburg. Univ.*, xxvi, Ser. D. (Med.), ii (Festschr. Nocht), pp. 184–196, 2 pls. Hamburg, 1927.

In continuation of the study of the Anophelines of Mexico [*R.A.E.*, B, xv, 198; xvii, 15], an account is given of their local and seasonal distribution. This country is of particular interest, as representatives of the mosquito faunas of North and South America reach the limits of their distribution in it. The North American species occurring in Mexico are *Anopheles crucians*, Wied., *A. quadrimaculatus*, Say, and *A. punctipennis*, Say. *A. crucians* is found along a narrow strip of the Gulf coast line, apparently preferring salt water for breeding. *A. quadrimaculatus* is more widely distributed and breeds almost exclusively in fresh water. It is abundant in places and with *A. pseudopunctipennis*, Theo., is responsible for local endemic malaria. *A. punctipennis* is less abundant; it occurs mainly further inland and is of little economic importance in Mexico.

The southern species occurring are:—*A. albimanus*, Wied., and *A. pseudopunctipennis*, both important vectors of malaria in Mexico; *A. vestitipennis*, D. & K., and *A. argyritarsis*, R.-D., which are of some importance in the south east of the country; and *A. punctimacula*, D. & K. (*strigimacula*, D. & K.), *A. apicimacula*, D. & K., *A. cruzi neivai*, H. D. & K., and *A. eiseni*, Coq., which are apparently of little importance, though their status has not yet been definitely ascertained.

A. albimanus is the commonest species during the rainy period in both the east and west coastal areas, though the damp climate along the east coast is most favourable to it. The larvae apparently require animal as well as vegetable food, so that they only occur in permanent collections of water that permit of the undisturbed development of a rich microfauna or in rain-water puddles in which a biological equilibrium has been reached; the latter are always exposed to sunlight. Running water is not suitable to them, but they occur in large numbers on the

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floating islands in the rivers. The vegetation and roots on these islands are apparently so dense that the water and fauna collected among them are not disturbed by the river current as the island moves down stream.

A. pseudopunctipennis occurs practically wherever conditions are suitable to its development. It is apparently the only malaria mosquito that is able to remain active throughout the hot, dry winter climate of the interior of Mexico. It occurs at altitudes of over 7,000 ft., and is responsible for endemic malaria in such localities. Algae are essential for its development, but animal matter is not so important, the larvae occurring in running water provided that it is clean and contains algae. Wherever this species is found along the coast, it remains near its breeding-places and seldom enters houses, but further inland it occurs more frequently in houses. The main factor concerned in this is probably the difference in the degree of humidity of the air.

JAMES (S. P.). **History of a Group of *Anopheles* Mosquitoes infected with *Plasmodium vivax* (Grassi & Feletti).**—*Abh. Gebiete Auslandsk. Hamburg. Univ.*, xxvi, Ser. D. (Med.), ii (Festschr. Nocht), pp. 220–222, 1 ref. Hamburg, 1927.

In a previous report [*R.A.E.*, B, xiv, 176] particulars were given of 18 batches of *Anopheles maculipennis*, Mg., infected with *Plasmodium vivax*, some of which survived and remained infective for 2½ months or more. The present paper deals with the history of some mosquitos that lived six months, during which period, after they had got rid of most of the sporozoites resulting from their first infection, they were reinfected from another patient and used successfully for inducing malaria in a second series of cases. Some of the mosquitos remained alive for nearly three months after their second infection. These observations show that *A. maculipennis* infected with a strain of *P. vivax* is not immune from reinfection by the same strain.

In a separate experiment it is shown that infected mosquitos do not lose their infectivity by being kept for six weeks at a temperature between 3° C. and 6° C. [37·4° F.–42·8° F.].

IRFAN (I.) & VOGEL (R.). **Stechmückenfangplätze in Anatolien 1926.** [Sites of Mosquito Captures in Anatolia in 1926.]—*Abh. Gebiete Auslandsk. Hamburg. Univ.*, xxvi, Ser. D. (Med.), ii (Festschr. Nocht), pp. 286–292. Hamburg, 1927.

This is a list of mosquitos occurring in Turkey, with notes on their local distribution; they include the Anophelines, *Anopheles bifurcatus*, L., *A. algeriensis*, Theo., *A. plumbeus*, Steph. (*nigripes*, Staeg.), *A. sacharovi*, Favr (*elutus*, Edw.), *A. maculipennis*, Mg., *A. hyrcanus* var. *sinensis*, Wied., *A. superpictus*, Grassi, and *A. multicolor*, Camb.

SABIT (M.). **Beiträge zum Studium der Morphologie und Biologie der Anopheleslarven in der Umgebung von Aïdin.** [Contribution to the Study of the Morphology and Biology of *Anopheles* Larvae in the Environs of Aidin.]—*Abh. Gebiete Auslandsk. Hamburg. Univ.*, xxvi, Ser. D. (Med.), ii (Festschr. Nocht), pp. 292–298. Hamburg, 1927.

The Anophelines occurring in the vicinity of Aidin are *Anopheles maculipennis*, Mg., *A. sacharovi*, Favr (*elutus*, Edw.), *A. bifurcatus*, L., *A. hyrcanus* var. *sinensis*, Wied., *A. algeriensis*, Theo., and *A. super-*

pictus, Grassi. The larvae of these species are described, and a key to them is given. Larvae of *A. maculipennis* may be found throughout the year, but their development is somewhat retarded from December to March. The winter is passed as a third or fourth instar larva as well as in the adult stage. *A. sacharovi* resembles *A. maculipennis* both as regards morphological and ecological characters. It usually breeds in stagnant, exposed and rather shallow water, with sparse vegetation that does not prevent the penetration of the sun's rays.

A. bifurcatus breeds in clear, slow-flowing or stagnant, shaded water. Hibernation occurs as usual in the larval stage, development being retarded from the end of December until March. About the middle of April or beginning of May numbers of first instar larvae are found; these may have emerged from eggs laid by overwintering females or probably from those laid by females resulting from the overwintering larvae. During the summer there occurs a definite retardation in the development or oviposition of the adults, as at that time, particularly in July and August, only very few larvae occur even in the most typical breeding-places. This delay appears to be closely related to the excessive heat of the local climate, which is contrary to the biological requirements of this species. *A. bifurcatus* is consequently the predominant species in the spring, and is replaced by *A. maculipennis* and *A. sacharovi* in the summer.

A. algeriensis is the least abundant of the Anophelines; the larvae are always found in company with other species in slow-running water where the vegetation is not high enough to shade it. They were most numerous in the summer; none was found during the first hot days (about May), when a number of newly emerged adults were on the wing.

A. hyrcanus var. *sinensis* breeds with other species, though mainly in places with abundant vegetation and exposed to sunlight but without any marked current. The larvae occurred in these places during the hottest period of July, but were never found in the winter, so that the hibernating stage in Asia Minor has not been ascertained.

A. superpictus prefers slowly running water in narrow valleys; the most suitable places are only exposed to the sun for a few hours each day, owing either to the formation of the banks or to the presence of trees. Local conditions are apparently not suitable for this species to hibernate in the larval stage, as the larvae would be washed away by the winter rains.

A. hyrcanus var. *sinensis* and *A. algeriensis* were never found in houses, but *A. maculipennis*, *A. superpictus* and particularly *A. sacharovi* were abundant in them. Malaria occurs in all three forms. *A. bifurcatus* is the chief carrier in the spring, but as it is a comparatively wild species, transmission at that time is insignificant. *A. maculipennis* and *A. sacharovi* (and to some extent *A. hyrcanus* var. *sinensis* and *A. algeriensis*) are responsible for malaria in the summer, and are replaced by *A. superpictus* in late summer and autumn, *A. superpictus* and *A. sacharovi* being the most important vectors.

VOGEL (R.) & MARTINI (E.). **Ueber die Oekologie der Anophelen in Anatolien.** [On the Ecology of the Anophelines in Anatolia.] *Abh. Gebiete Auslandsk. Hamburg. Univ.*, xxvi, Ser. D. (Med.), ii (Festschr. Nocht), pp. 298–308. Hamburg, 1927.

This is a more detailed account of the local breeding-places and seasonal history of the Anophelines occurring in Anatolia [see

preceding papers]. The observations indicate that in climates such as that of Anatolia the salt content of the soil affects many of the breeding-places of mosquitos. In this connection it is noteworthy that *Aëdes detritus*, Hal. (*salinus*, Fic.) occurs in Aidin in the Mender Valley. In spite of the great differences in climate, topography, vegetation and cultivation in the various regions of Anatolia, Anophelines have apparently adapted themselves to these various conditions and are probably distributed throughout the country.

[Martzinovskiĭ] Marzinowsky (E.). **Ueber das Zecken-Rückfallfieber.** [Concerning Tick Relapsing Fever.]—*Abh. Gebiete Auslandsk. Hamburg. Univ.*, xxvi, Ser. D. (Med.), ii (Festschr. Nocht), pp. 314–318, 4 figs., 6 refs. Hamburg, 1927.

Previous work on tick-borne relapsing fever in Central Asia is briefly reviewed, and the course of the disease in Turkestan during 1926 is discussed. There were two definite peaks ; the first in March–April and the second in September, the latter being probably due to the appearance of a fresh generation of ticks. The species observed in the Republics of Central Asia are *Ornithodorus tholozani*, Lab. & Mégn., and *O. lahorensis*, Neum. Another species has been described by Isakyan, but not identified. Experiments by S. W. Wiskowski have confirmed those of Latuishev [*cf. R.A.E.*, B, xv, 95, 215], showing that the disease is transmitted by *O. tholozani*.

Though no cases of relapsing fever were recorded from the Transcaucasian Republics before the War, it is believed that careful study will prove the existence of indigenous cases. It is suggested that the disease was originally introduced into Transcaucasia and Turkestan with black slaves from Africa and that the African spirochaete became adapted to the local species of *Ornithodorus*.

Reichenow (E.) & Regendanz (P.). **Ueber die Flohpassage normaler und mit Arsenophenylglycin vorbehandelter Rattentrypanosomen.** [On the Passage of normal Rat Trypanosomes and of those previously treated with Arsenophenylglycin through Fleas.]—*Abh. Gebiete Auslandsk. Hamburg. Univ.*, xxvi, Ser. D. (Med.), ii (Festschr. Nocht), pp. 446–460, 15 refs. Hamburg, 1927.

In the experiments on the development of *Trypanosoma lewisi* in *Ctenocephalus canis*, Curtis (dog flea), it was found that the presence of trypanosomes in the fleas depends on their density in the rat and the temperature of the air in which the fleas are kept, 18° C. [64·4° F.] being the lowest temperature at which development occurred in the gut of the fleas.

The effect of a given dosage of arsenophenylglycin on *T. lewisi* depends partly on the density of the trypanosomes, which are also more susceptible to the drug during the reproductive stage than when division is complete. The technique of certain successful experiments in raising the resistance of the trypanosomes to the drug is described ; this resistance was not affected by the passage of the trypanosomes through fleas.

Schüffner (W.), Mochtar (A.), Proehoenian (S.) & Honig (L.). **Weitere Beiträge zur Aetiologie des Gelbfiebers und der Bedeutung der *Leptospira icteroides* Noguchi.** [Further Contributions to the Aetiology of Yellow Fever and the Importance of *L. icteroides*, Nog.]—*Abh. Gebiete Auslandsk. Hamburg. Univ.*, xxvi, Ser. D. (Med.), ii (Festschr. Nocht), pp. 500–506, 5 refs. Hamburg, 1927.

The results of previous work [*R.A.E.*, B, xv, 93] differing from those of Noguchi [*R.A.E.*, B, xiii, 121] are discussed, and serological and immunological experiments are described, which prove that *Leptospira icteroides* is identical with *L. icterohaemorrhagiae*. All transmission experiments with *Aëdes argenteus*, Poir. (*aegypti*, L.) failed.

Sfarčić (A.). **Malaria in Dalmatien und ihre Bekämpfung.** [Malaria and its Control in Dalmatia.]—*Abh. Gebiete Auslandsk. Hamburg. Univ.*, xxvi, Ser. D. (Med.), ii (Festschr. Nocht), pp. 532–538, 3 figs., 2 refs. Hamburg, 1927.

Observations made during the past few years in Dalmatia on the distribution and control of malaria are discussed [*cf. R.A.E.*, B, xiii, 82, 92, 188]. All three malarial parasites are present, and their local and seasonal prevalence as observed in 1923–26 is shown in tables. The comparative mildness of the disease, which is seldom fatal, is probably due to the species of mosquito concerned in its transmission. Those so far recorded are *Anopheles maculipennis*, Mg., *A. sacharovi*, Favr (*elutus*, Edw.), *A. hyrcanus* var. *sinensis*, Wied., and *A. superpictus*, Grassi. More serious epidemics occasionally occur; in one such case *A. superpictus* appeared to be the only mosquito present, and the principal parasite was *Plasmodium falciparum* (*immaculatum*). The pecularities of the water-supply in certain districts of Dalmatia and the methods by which it has been reorganised with a view to diminishing mosquito breeding are described. The establishment of the Brazilian fish, *Gambusia affinis*, has been of particular value, as owing to the scarcity of water every effort has to be made to conserve it.

Yamasaki (S.). **Ueber eine zweigeisselige Flagellatenart im Darm von *Lucilia* sp.** (*jeddensis* ?). [On the Occurrence of a Biflagellated Organism in *Lucilia* sp.]—*Abh. Gebiete Auslandsk. Hamburg. Univ.*, xxvi, Ser. D. (Med.), ii (Festschr. Nocht), pp. 605–607, 15 refs. Hamburg, 1927.

The author describes a biflagellated organism closely resembling *Herpetomonas muscae-domesticae* that he has observed in a series of *Lucilia* sp.

Zschucke (—). **Ein Beitrag zur Frage der Stechmückenbekämpfung.** [Contribution to the Question of Mosquito Control.]—*Abh. Gebiete Auslandsk. Hamburg. Univ.*, xxvi, Ser. D. (Med.), ii (Festschr. Nocht), pp. 631–637, 2 refs. Hamburg, 1927.

The work described was undertaken as a result of the great increase of mosquitos in the valleys of the Elbe and Mulde after the spring floods of 1926. The region studied is sparsely populated, the buildings are primitive, and large flood areas occur in years of heavy rainfall. In most cases the destruction of breeding-places by draining, etc., is impossible.

Preliminary experiments were carried out in the laboratory with petroleum and various proprietary preparations, using tap water and the larvae of *Aëdes argenteus*, Poir. The materials included a new preparation made by the author as a result of tests with various pyrethrum extracts with the addition of chemical spreaders. This gave very promising results and has been tried under natural conditions where a species of *Aëdes* was abundant. The water was sprayed with the material, at the rate of about 4·5 gm. to the square metre, by means of an ordinary fruit-tree sprayer. The water surface treated amounted to about 4 acres. Only a few larvae were found in the largest pond after treatment, the rest were all clear.

EYSELL (A.). **Beiträge zur Lebensgeschichte von** *Aëdes argenteus*, **der Gelbfiebermücke.** [Contributions to the Life-history of *A. argenteus*, the Yellow Fever Mosquito.]—*Abh. Gebiete Auslandsk. Hamburg. Univ.*, xxvi, Ser. D. (Med.), ii (Festschr. Nocht), pp. 638–640. Hamburg, 1927.

Brief notes are given of observations made on laboratory-bred examples of *Aëdes argenteus*, Poir. Some eggs, that had been kept nearly seven months at ordinary dry room temperature and were considerably shrivelled, hatched normally.

NERI (F.). **Sulla presenza di** *Stegomyia calopus* **nel basso Litorale Adriatico (Bari) e sua importanza epidemiologica.** [The Presence of *Aëdes argenteus* on the Adriatic Coast of South Italy and its epidemiological Importance.]—*Ann. Igiene*, xxxviii, no. 10, pp. 777–781. Rome, October 1928.

Though *Aëdes argenteus*, Poir. (*Stegomyia calopus*, Mg.) has been recorded from various parts of the Mediterranean, no observations appear to have been published from the Adriatic coast of southern Italy. The author gives a brief note on his captures since 1927 and concludes that the abundance of this mosquito is increasing at Bari, between which and the eastern Mediterranean a considerable flow of traffic occurs, so that there seems to be a danger of an invasion of dengue, which was epidemic in Greece in 1927 and pandemic in 1928.

CIARROCCHI (L.). **Dermatite pruriginosa prodotta dal** *Pediculoides ventricosus* **manifestatasi in forma epidemica.** [An Epidemic of Dermatitis due to *P. ventricosus*.]—*Ann. Igiene*, xxxviii, no. 10, pp. 788–814, 5 figs., 56 refs. Rome, October 1928.

An account is given of an epidemic of dermatitis near Rome caused by *Pediculoides ventricosus*, Newp. Many mites were found in damaged grain, which is either ground or sown between September and November, the period during which the outbreak occurred. A description of the mite and its habits is given from the literature.

[GONCHAROV (G. D.).] **Гончаров (Г. Д.). Nutrition of the Larvae of** *Anopheles maculipennis* **under artificial Conditions.** [*In Russian.*]—*Russ. J. Trop. Med.*, vi, no. 8, pp. 482–488, 2 figs., 5 refs. Moscow, 1928. (With a Summary in French.)

Laboratory experiments were made in the summer of 1927 on the relation of the chemical composition of waters to the distribution and

development of the larvae of *Anopheles maculipennis*, Mg., and on the nutrition of the larvae. Methods of dissecting the latter are fully described. The larvae of *A. maculipennis* in all instars appear to be general feeders; the gut contents are always a fine granular mass and include vegetative forms (chiefly Volvocineae and Protococcoideae) as well as animal forms (mainly Rotifers). There exists a direct correlation between the nutritive contents of the digestive tubes of the larvae and the elements of the plankton. In water with a small content of calcium (10 mg. per litre), but a rich plankton, the development of the larvae was not retarded, as the lack of calcium was evidently compensated by the nutritive elements present.

[Yakimov (V. L.) & Rastegaeva (E. F.).] **Якимов (В. Л.) и Растегаева (Е. Ф.). Experimental Transmission of** *Françaiella colchica* **by Ticks.** [*In Russian.*]—*Russ. J. Trop. Med.*, vi, no. 8, pp. 514–521, 6 refs. Moscow, 1928.

Experiments were carried out in Leningrad in the winter of 1927 with larvae of *Boophilus annulatus calcaratus*, Birula, reared from individuals taken in the North Caucasus on cattle infected with red-water, to determine whether this tick can transmit the causal agent, *Françaiella colchica*. The larvae were fed on the ear of a healthy cow, and daily examinations of the blood showed the presence of infection on the 17th day; on the 22nd day the animal died of the disease. The similarity between this disease and that recorded from Algeria as caused by *Babesiella major* is briefly discussed.

[Shakhov (S. D.).] **Шахов (С. Д.). A Year's Work at the Entomological Laboratory of Eskhar.** [*In Russian.*]—*Russ. J. Trop. Med.*, vi, no. 9, pp. 545–555, 9 figs., 1 ref. Moscow, 1928.

Artificial and natural water reservoirs near Kharkov are described in detail, and a list is given of 19 species of mosquitos occurring there, including the Anophelines, *Anopheles maculipennis*, Mg., *A. bifurcatus*, L., and *A. plumbeus*, Steph. Natural infection with malaria was very rare, and only occurred in *A. maculipennis*. The technique of the control of mosquitos in their breeding-places by applying crude oil is fully described, and this method has proved very efficacious. The mosquitos found hibernating in buildings were *Culex pipiens*, L., and *A. maculipennis*, which occurred in cellars, where the average temperature varied between 4 and −8° C. (39·2 17·6° F.). These were destroyed with flares, the measure being repeated four times in the course of the winter. *A. bifurcatus* and *A. plumbeus* were found hibernating in forests in hollow trees, and the hollows were filled with earth, but the author does not consider this method to be very effective. Both *A. bifurcatus* and *A. plumbeus* attack man during the day, the former in and outside forests and the latter only within them. The author considers, however, that all three species are capable of transmitting malaria.

Martini (E.). **Zur Biologie von** *Anopheles maculipennis*. [*Also in Russian.*—*Russ. J. Trop. Med.*, vi, no. 9, pp. 562–564. Moscow, 1928.

This is a brief note on an article by Solov'ev on the biology of *Anopheles maculipennis*, Mg. The characteristic resting attitudes of Anophelines

and Culicines are discussed. Solov'ev considered that the difference in the attitude of the mosquitos during rest is not a sufficient ground for distinguishing them, but the author regards it as the most important mark of differentiation. The attitude of the mosquitos depends largely on the time of the year, and also on the nature and position of the surface on which they rest. The deviation of the abdomen of the mosquito from the surface is not important, but the angle formed by the thorax in case of Culicines and the absence of this angle in case of Anophelines do not vary with the seasons and are not affected by the surface on which the mosquito rests. *Corethra* spp. rest in exactly the same manner as Anophelines, and *Anopheles* (*Chagasia*) *fajardoi*, Lutz, is stated to be the only Anopheline that rests in a pose characteristic of Culicines.

PLETNJOW (E. A.). **Zur Biologie und Oekologie der Mücken (Culicidae) des Tomsker Kreises.** [Biology and Ecology of Culicids of the Tomsk Region.]—*Arch. Naturgesch.*, Abt. A, xcii (1926), no. 12, pp. 1–27, 27 refs. Berlin, December 1928.

The Tomsk region, especially in the north, with its extensive areas of forest and marsh, provides excellent breeding grounds for mosquitos. Among the 21 species recorded, only *Anopheles maculipennis*, Mg., appears to transmit malaria. Although it is encountered during the day at a distance from dwellings, it is essentially a domestic and nocturnal species. After hibernation, which occurs chiefly in cellars and sheds and which may begin as early as September, the adults swarm in March, April or May, according to the temperature. The eggs hatch in 3–4 days, the larval stage lasting 14–26 days, depending on temperature and food conditions, and the pupal stage 3–5.

LEGENDRE (J.). **La concurrence entre moustiques zoophiles et anthropophiles.**—*C.R. Acad. Sci. Fr.*, clxxxviii, no. 1, pp. 95–97, 1 ref Paris, 1929.

Continuing observations on the races of *Culex pipiens*, L., that attack or avoid man at Pons [*R.A.E.*, B, xvi, 39], the author established the latter race in a tub, the sole breeding-place, in a garden where the inhabitants were being bitten. In a month the substitution was complete, no complaint of attack being obtainable. It is suggested that the ability of the man-avoiding race of *C. pipiens* to supplant the other one might be tested in the case of other Culicines. Similarly, the strictly man-avoiding race of *Anopheles maculipennis*, Mg., of Brittany, Saintonge and Provence might be introduced into malarial districts where the same species, or others, transmit the disease.

GALLI-VALERIO (B.). **Beobachtungen über Culiciden, nebst Bemerkungen über Tabaniden, Simuliden und Chironomiden.** [Observations on Culicids, with Remarks on Tabanids, Simuliids and Chironomids.]—*Centralbl. Bakt.* (1) Orig., cx, no. 1–3, pp. 100–101. Jena, 2nd January 1929.

These notes on observations in Switzerland in 1926–27 are on the same lines as in previous years [*R.A.E.*, B, xv, 122]. At Vidy, *Glyceria plicata* favoured the breeding of mosquitos. With the disappearance of green algae, *Anopheles maculipennis*, Mg., became scarce in a lake, but *Culex pipiens*, L., developed in numbers. As in the two preceding years, Tabanids were scarce in Alpine pastures in Vaud and Valais.

Ottolenghi (D.) & Rossetti (G.). [**Experimental Infection of *Anopheles maculipennis* and *A. sacharovi* with Malaria.**]—*Boll. Soc. ital. Biol. sperim.*, 1928, no. 9 : Sez. di Bologna, sed. 9 Dic. 1927. (Abstract in *Riv. Malariologia*, vii, no. 5, pp. 761–762. Rome, 1928.)

Anopheles maculipennis, Mg., and *A. sacharovi*, Favr (*elutus*, Edw.) have been experimentally infected to the extent of 30–50 per cent. by being caused to bite patients suffering from benign tertian malaria [*Plasmodium vivax*], and the mosquitos remained infected for 4 months at a low temperature of 3° C. [37·4° F.]. Mosquitos from places where malaria does not occur were readily infected. No difference in behaviour was observed between the two species. In mixed infections of benign and malignant tertian [*P. falciparum*], one species sometimes became infected with benign tertian and the other with malignant tertian. One bite from an infected mosquito (even if it had bitten several persons) sufficed to transmit malaria.

du Toit (P. J.). **A Note on the Longevity of the Brown Tick** *Rhipicephalus appendiculatus*.—*S. Afr. J. Sci.*, xxv, pp. 288–290, 5 refs. Johannesburg, 1928.

Measures for the control of the brown tick, *Rhipicephalus appendiculatus*, Neum., which is the vector of two of the most important cattle diseases in South Africa, red-water and African coast fever, are based on the fact that the adults were found to live without a feed for a maximum period of 14 months. Nevertheless, under laboratory conditions these ticks may live considerably longer. In recent experiments in which two batches of nymphs were fed on a cow on the same day and allowed to moult, the last survivor from one lot lived for 843 days, and from the other for 901 days, after being first observed ; the first batch had all moulted within the first 42 days and the other within 48 days. Nymphs of a third lot that were fed on two calves and had moulted within 67 days were placed on the ears of a calf 913 days after the beginning of the experiment, but died the next day without having attached themselves to their host. Some larvae that were fed on 2nd April 1927 became nymphs by the 30th. These nymphs were still quite lively on 19th April 1928, when they engorged within 4 days on the ears of a calf.

De Meillon (B.). **Notes on some Mosquitos found in South Africa, I.**—*S. Afr. J. Sci.*, xxv, pp. 316–324, 20 figs., 6 refs. Johannesburg, 1928.

Anophelines bred from larvae collected in streams and pools in the vicinity of Johannesburg, where they are less common than Culicines, chiefly owing to the lack of suitable breeding-places, included *Anopheles mauritianus*, Grp., *A. pretoriensis*, Theo., *A. cinereus*, Theo., *A. squamosus*, Theo., and *A. rhodesiensis*, Theo. None of these species is known to be a vector of malaria, although *A. rhodesiensis* has been suspected of carrying the disease. Descriptions are given of the larvae of *A. longipalpis*, Theo., and of *A. marshalli*, Theo., from the Eastern Transvaal. The characters distinguishing the larvae and pupae of *Culex theileri*, Theo., and *C. univittatus*, Theo., are given, and the male hypopygium of *Culex* (*Micraëdes*) *inconspicuosus*, Theo., is described.

Paterson (A. R.). **Malaria and Development : The Report of the Malaria Commission of the League of Nations on "Principles and Methods of Anti-malarial Measures in Europe" in Relation to Conditions in Kenya.**—*Kenya & E. Afr. Med. J.*, v, no. 8, pp. 251–281. Nairobi, November 1928.

The status of malaria in Kenya and the possible means of its prevention are reviewed [*R.A.E.*, B, xvi, 126, 241] ; the presence of malaria in parts of Kenya that were previously free from the disease is accounted for by the fact that infected labourers have been employed in these areas. The author points out that the methods for the prevention of malaria carried out in other countries are not applicable to Kenya, and goes on to discuss the proposals put forward by the League of Nations Commission [xvi, 147] and their bearing on Kenya conditions. Although the prevention of mosquito breeding and the anti-malarial measures that may be adopted where sufficient funds are available are efficient, the protection of native labourers will only be brought about by intensive agricultural development, accompanied by educational work and the scientific management of farms and estates.

Foley (H.). **Sur quelques Diptères piqueurs récoltés au cours de la mission du Hoggar. 1re note.**—*Bull. Soc. Hist. nat. Afr. N.*, xix, no. 8, pp. 267–272, 1 fig., 2 refs. Algiers, 1928.

Anophelines found over a large area of the Sahara to the south of Algeria between February and May 1928 include *Anopheles multicolor*, Camb., *A. sergenti*, Theo., and *A. hispaniola*, Theo. The last-named has been recorded twice previously from the northern Sahara, breeding even in small collections of brackish water, though its favourite habitat is fresh water containing vegetation, and the present discoveries extend its range almost to the tropical region. No *Phlebotomus* was observed in the few buildings examined, but a species resembling *P. papatasii*, Scop., was captured in the open. The general characters of the female are described.

Sicé (A.) & Vaucel (M.). **Etude des gîtes à larves de moustiques à Brazzaville ; présence du** *Stegomyia fasciata*.—*Bull. Soc. Path. exot.*, xxi, no. 9, pp. 768–770. Paris, 1928.

Owing to the number of cases of yellow fever occurring at Matadi at the end of 1927, a survey of Brazzaville was carried out from January to September 1928, and 258 mosquito breeding-places were discovered, including 104 containing larvae of *Stegomyia* either alone or in association with those of *Anopheles* or *Culex*. *Aëdes* (*Stegomyia*) *argenteus*, Poir., occurred 97 times, *A.* (*S.*) *terrens*, Wlk., 3 times, *A.* (*S.*) *vittatus*, Big. (*sugens*, Wied.), twice, *A.* (*S.*) *africanus*, Theo., once, and *A.* (*S.*) *marshalli*, Theo., once. The number of breeding-places of *Stegomyia* is greatest after heavy rains. The percentage of breeding-places containing *Stegomyia* was 46·8 from January to June, whereas it was only 2·2 from July to September. Of these, 59 were found in dwellings and their immediate vicinity, 32 in stagnant water and 7 in running water, and the locality of 6 was unknown ; only 24 were outside the European settlement. On the other hand, Anopheline larvae, chiefly *Anopheles gambiae*, Giles (*Pyretophorus costalis*, Theo.), occur mostly in marshes and stagnant water in the neighbourhood of native villages; they were only found twice near European dwellings. This explains the scarcity

of malaria among Europeans and the high rate of infection among native children up to 15 years old, which reaches 29 per cent. In view of a possible epidemic of yellow fever, a strict and continuous survey of the breeding-places of *Stegomyia* should be maintained.

VAN THIEL (P. H.). **La nourriture des larves de l'*Anopheles maculipennis* en rapport avec le problème de l'existence de la variété *atroparvus*.** — *Bull. Soc. Path. exot.*, xxi, nos. 7–9, pp. 551 574, 687–693, 797–807, 41 refs. Paris, 1928.

Although the author concludes from previous investigations [*R.A.E.*, B, xv, 180] that the variation in size of the two groups of *Anopheles maculipennis*, Mg., occurring in the Netherlands is almost certainly a question of racial differences, the possibility that the smaller quantity and also perhaps the difference in the quality of the food may have caused a diminution in the size of the mosquitos at Bolsward has not been excluded, and for this reason the present detailed study of the food of *A. maculipennis* in the two regions where the large and small races occur has been made.

The literature on the food of Anophelines in different parts of the world is reviewed at some length. Localities in the two regions were selected, and an effort was made, not always successfully, to take 5 larvae from 10 breeding-places in each locality. The method of dissection is briefly discussed. In each breeding-place, the salinity of the water was determined and the macroscopic vegetation noted.

A table is given showing the wing measurements of adults captured at the time the larvae were taken, and comparisons are made between the sizes of the mosquitos taken in the various localities of the two regions. Tables are also given showing the various kinds of organic and other material found in the digestive tracts of the larvae. Notes are given on each separate food element, and its nutritional value is discussed.

The literature dealing with the influence of nourishment on the size of mosquitos (and, in one case, of flies) is briefly reviewed. Comparisons were made of the food materials found in the different localities for which wing measurements were compared in an effort to account for the variations in size, but after a discussion of the food materials present in localities where no measurements were made, the author concludes that differences in the food materials of the larvae are not responsible for the local diminution in the size of the adults. Moreover, the quantity of plankton occurring towards the end of the summer increases, whereas the size of the adults decreases ; and the large size of the first generation of Anophelines is evidently not entirely due to richer food, the contents of the digestive tract of larvae taken at Leyden in May being extremely poor. Owing to lack of knowledge of the digestive physiology of *Anopheles* and of the exact nutritional value of the food elements, no very definite conclusions can be made, but observations seem to indicate that food is not the only factor affecting the size of *A. maculipennis*.

As it seemed clear that the problem of the origin of the small sized mosquito, *A. maculipennis* var. *atroparvus*, van Thiel, could not be solved by a study of the contents of the digestive tract alone, adults were reared from eggs laid by females taken at Leyden in the region of large mosquitos, and from Heemstede, in the region of small mosquitos. Breeding took place at the same time and under the same conditions.

On the average the progeny of mosquitos from Heemstede were smaller than those of females from Leyden, and the existence of the variety *A. maculipennis* var. *atroparvus* is further supported by the fact that the important difference in colour already mentioned [*loc. cit.*] was maintained in the reared mosquitos.

In an addendum, the macroscopic vegetation of the breeding-places is discussed, and the author concludes that the distribution of macroscopic vegetation does not indicate a corresponding one of microscopic plants.

BRUG (S. L.). **Filariasis in Ned.-Indië.** [Filariasis in the Dutch East Indies.]—*Geneesk. Tijdschr. Ned.-Ind.*, lxviii, no. 5, pp. 681–704, 9 figs., 1 pl., 49 refs. Weltevreden, 1928.

An account is given of the occurrence of filariasis in the Dutch East Indies, *Filaria* (*Microfilaria*) *bancrofti* and *F.* (*M.*) *malayi* [*R.A.E.*, B, xvi, 41] being the agents concerned. The latter has now been recorded from various parts of the Dutch East Indies and, like *F. bancrofti*, occurs in the blood stream at night. *Culex fatigans*, Wied., the chief vector of *F. bancrofti*, does not appear to be important as regards *F. malayi*, and though the latter is almost certainly transmitted by some blood-sucking insect, it is possible that this may not be a mosquito.

SOESILO (R.). **De experimenteele ontvankelijkheid van** *Myz. rossii* **voor malaria-infecties.** [The experimental Susceptibility of *Anopheles subpictus* to Malaria Infection.]—*Geneesk. Tijdschr. Ned.-Ind.*, lxviii, no. 5, pp. 725–731, 10 refs. Weltevreden, 1928.

Infection experiments were made at Batavia with *Anopheles subpictus*, Grassi (*rossi*, Giles) bred from larvae taken from salt-water fish-ponds in the district, and also with adults of the divergent type (the 3 pairs of clypeal hairs forked) from larvae collected in fresh water. The percentages of infection obtained with malignant tertian malaria [*Plasmodium falciparum*] were 85·7 for the mosquitos from salt water and 80 for those from fresh water, as compared with 86·9 for *A. ludlowi*, Theo. Similar results were obtained with benign tertian [*P. vivax*]. The slight infection of *A. subpictus* in nature is due solely to its preference for feeding on animals.

CHRISTOPHERS (S. R.), SINTON (J. A.) & COVELL (G.). **How to do a Malaria Survey.**—*Health Bull.*, no. 14 (*Malaria Bur.*, no. 6), 147 pp., 11 pls. Calcutta, Govt. India Central Pubn. Br., 1928. Price 10*d.*

Full information is given on the methods and technique involved in a complete elucidation of the facts about malaria in any particular locality or area. In addition to chapters dealing with apparatus required, preparation of maps, collection of adult mosquitos and larvae, dissections to determine the age and condition of females and the presence of malaria parasites, spleen rate and parasite index, are others on the collection and use of statistical data, and on studies of the physical features, of the meteorological, economic, and human conditions obtaining in the area and of immigration. The results of a survey are discussed, and notes are given in the appendix on the registration and compilation of vital statistics in various Indian provinces.

DA COSTA LIMA (A.). **Ceratopogonineos ectoparasitos de phasmideos.** [Ceratopogonid Ectoparasites of Phasmids.]—*Suppl. Mem. Inst. Oswaldo Cruz.*, no. 3, pp. 84–85, 5 figs., 3 refs. Rio de Janeiro, November 1928.

A Ceratopogonid taken on a Phasmid in Brazil is described as *Forcipomyia obesa*, sp. n., and reference is made to another species recently described from Paraguay [*R.A.E.*, B, xvi, 233].

DA COSTA LIMA (A.). **Sobre algumas anophelinas encontradas no Brasil.** [On some Anophelines found in Brazil.]—*Suppl. Mem. Inst. Oswaldo Cruz*, no. 3, pp. 91–113, 25 figs., 40 refs. Rio de Janeiro, November 1928.

The greater part of this paper is identical with others already noticed [*R.A.E.*, B, xvi, 215 ; xvii, 14], but it includes notes on the group of the subgenus *Nyssorhynchus* comprising species in which the last three tarsal joints of the hind legs are completely white. The author recognizes three distinct species, *Anopheles argyritarsis*, R.-D., *A. albitarsis*, Arrib., and *A. darlingi*, Root (which has not been studied by him). *A. argyritarsis* var. *allopha*, Lutz & Peryassú, is not considered a distinct variety, and *A. rooti*, Brèthes, is also probably a synonym of *A. argyritarsis*. The author agrees with Root [xiv, 197] in regarding *A. brasiliensis*, Chagas, as a variety (or possibly a variation) of *A. albitarsis*. *A. argyritarsis* in Brazil seems to be a less important vector of malaria than *A. albitarsis*. The latter closely resembles *A. tarsimaculatus*, Goeldi. The paper concludes with a key to the species of the *Nyssorhynchus* group.

KUMM (H. W.). **Studies in the Dispersion of *Anopheles* Mosquitoes.**—*Amer. J. Trop. Med.*, ix, no. 1, pp. 67–77, 1 map, 5 refs. Baltimore, Md., January 1929.

Experiments on the dispersion of Anophelines were made in North Carolina between 21st July and 5th August 1927. Collections were made in 2 mule sheds, in 5 houses and underneath 2 houses, 5,541 mosquitos in all being caught, of which 95·5 per cent. were *A. quadrimaculatus*, Say, 3·7 per cent. *A. punctipennis*, Say, and 0·7 per cent. *A. crucians*, Wied. ; of these 616 were stained, 428 with methylene blue and 188 with eosin. Tables are given showing the numbers caught, the results of control experiments made to test the effectiveness of the stains, the extent of the dispersion of the mosquitos and the number of days elapsing between staining and recapture, with a sketch map illustrating the general appearance of the area in which the experiments were made. The maximum flight noted was 0·4 miles, 3·7 per cent. of the mosquitos stained being recaptured and only 1·9 per cent. of the total number being found in the place in which they had been released. The maximum interval of time after which stained mosquitos were caught was 9 days. It is therefore concluded that there is a marked daily dispersion of Anophelines in North Carolina during the height of summer, very few remaining for more than 24 hours in the place where they have had a blood meal.

RUDOLFS (W.) & LACKEY (J. B.). **The Composition of Water and Mosquito Breeding.**—*Amer. J. Hyg.*, ix, no. 1, pp. 160–180, 6 figs., 9 refs. Lancaster, Pa., January 1929.

The following is largely taken from the authors' summary. An attempt has been made to correlate the chemical composition of water and the biological growth contained in it with the abundance of mosquitos. In this connection, larvae of *Culex pipiens*, L., were introduced into rain-water and waters collected from certain drainage areas, including cedar swamps [*cf. R.A.E.*, B, xiii, 25]. They died within 24 hours when the pH values of the natural waters were rapidly changed, but the death rate was not appreciably affected by a gradual change.

Two definite pools were selected, one in which little or no breeding had taken place, and another where *Aëdes canadensis*, Theo., had occurred for several years. During this time analyses of the waters had been regularly made. Larvae were present with either low or high acidity, with free CO_2 of 4 and 40 p.p.m., with 5 and 75 p.p.m. chlorides, with 2 and 112 p.p.m. sulphates; with high and low acid carbonates, free ammonia and albuminoid ammonia. Breeding was absent whenever the amounts of diatoms, protozoa, fungi, etc., were low, but occurred with high and low total numbers of bacteria, and was unaffected by the carbon-nitrogen ratios. There was a marked difference in decomposition of mixtures of mud and partly decayed vegetable matter obtained from the bottoms of the pools. It is possible that under certain circumstances water with low pH values is more favourable to mosquito breeding than that with medium or high ones, and *vice versa*. It appears that specific substances either present in the water or produced by the decomposition of vegetable matter may be responsible for the growth of micro-organisms and subsequently for the breeding of mosquitos.

YOUNG (C. W.) & HERTIG (M.). **The Kala Azar Transmission Problem: Field and Laboratory Studies in China. I. Epidemiology.**—*Amer. J. Hyg.*, ix, no. 1, pp. 227–246, 2 figs., 29 refs. Lancaster, Pa., January 1929.

This is the first of a series of papers giving accounts of studies carried out in China from 1924 to 1927 on the transmission of kala-azar. The epidemiology of the disease in China is discussed and compared with that in India. The status of the transmission problem before 1924 is reviewed, and the various hypotheses that the authors have since attempted to test are outlined. No evidence was obtained in support of the hypothesis of a rodent reservoir and ectoparasite vector, and attempts to infect various flea larvae failed. With regard to the sandfly hypothesis, collateral studies have sought to determine the degree to which the striking phenomena involved in the development of *Leishmania* in the intestines of bed-bugs and sandflies may be taken as indications of specificity. It was found that when *Leishmania donovani* from the spleen of the hamster is injected into the coelomic cavity of either of these insects, it multiplies and produces flagellate forms. The latter may be seen for at least 9 days in *Phlebotomus sergenti*, Parrot, and are capable of producing infection on being injected into hamsters, in the case of the bed-bug, *Cimex lectularius*, L., for a period of at least 40 days.

White (G. F.) & Dove (W. E.). **The Causation of Creeping Eruption.** —*J. Amer. Med. Ass.*, xc, pp. 1701–1704, 7 figs., 11 refs. Chicago, Ill., 26th May 1928.

Reference is made to cases of "creeping disease" in man caused by the larvae of Oestrids, particularly *Oestrus* (*Gastrophilus*). Creeping diseases in man are more often caused by Nematodes, a species of which is shown in this paper to be the cause of skin lesions in Florida. The authors suggest that the term "creeping eruption" should be confined to the creeping disease produced by this parasite, which is frequently encountered in the southern United States.

Mohler (J. R.). **Report [1927-28] of the Chief of the Bureau of Animal Industry.**—53 pp. Washington, D.C., U.S. Dept. Agric., 1928.

An account is given of anaplasmosis in cattle in Florida that has been noticed elsewhere [*R.A.E.*, A, xvi, 161]. Investigations into the life history of *Hymenolepis carioca*, a Cestode parasite of poultry, showed that the alternative host is probably the dung beetle, *Aphodius granarius*, L. Since these beetles are sufficiently small to pass through screens that will exclude flies, certain modifications will be necessary in cases where attempts are being made to rear chickens free from tapeworms by using screened enclosures.

Swenk (M. H.) & Mussehl (F. E.). **The Insects and Mites injurious to Poultry in Nebraska and their Control.**—*Circ. Nebraska Agric. Expt. Sta.*, no. 37, 31 pp., 10 figs. Lincoln, Neb., December 1928.

Among the less well known parasites of poultry dealt with are *Laminosioptes cysticola*, Viz. (flesh mite) and *Cytoleichus nudus*, Viz. (pulmonary mite). *Macrodactylus subspinosus*, F. (rose-chafer) is poisonous to young birds, and young chickens and turkeys are occasionally killed in attempting to eat corn billbugs, *Sphenophorus* (*Calendra*) spp., the latter clinging to their bills, etc., and choking them.

Ewing (H. E.). **Birds as Hosts for the common Chigger.**—*Amer. Nat.*, lxiii, no. 684, pp. 94–96. New York, N.Y., 1929.

Of 34 species of birds examined from Virginia and North Carolina, 7 were infested by *Trombicula irritans*, Riley. In many localities ground-frequenting birds appear of more importance as hosts of this mite than rabbits or box turtles.

Section of Medical Entomology.—*Med. Rep. & Rep. Med. Res. Lab. Kenya 1927*, pp. 114–116. Nairobi, 1928.

At the time when this report was written, a few of the unfed larvae of *Ornithodorus moubata*, Murr., obtained from eggs in 1926 [*R.A.E.*, B, xvi, 127], were still alive, having survived for 710 days without food. Surveys of rat fleas in several townships have been continued; *Xenopsylla astia*, Roths., is only known to occur at Mombasa. A survey of field and domestic rodents has been begun in one district, the main objects being to determine whether plague occurs among the field rodents, and whether they carry the same species of fleas as the domestic ones. Some 250 specimens, of both field and domestic species, have been

collected, and *Xenopsylla cheopis*, Roths., has proved to be as common on the former as on the latter. None of the rodents has been found to be infected with plague, though before the survey was begun, specimens of *Arvicanthis abyssinicus* infected with plague occurred in the district.

MANSFIELD-ADERS (W.). **Annual Report of the Biological Division, 1927.**—*Adm. Rep. Zanzibar Prot. 1927*, pp. 163–192. Zanzibar, 1928.

A rat flea survey was made in Zanzibar in 1927, the monthly records of the first three species mentioned being shown in a series of tables. *Xenopsylla cheopis*, Roths., was found to be the commonest species on all rats; *X. brasiliensis*, Baker, was frequently found, but *X. astia*, Roths., was extremely rare. *X. crinita*, J. & R., has been recorded from *Cricetomys gambianus*, and *Echidnophaga gallinacea*, Westw., and *Ctenocephalus felis*, Bch., from common town rats, but these fleas are not vectors of plague. The insectivore, *Pachyura coerulea*, is often trapped in the town and is a host of *X. cheopis*.

THEILER (Sir A.) & DU TOIT (P. J.). **The Transmission of Tick-borne Diseases by the intrajugular Injection of the emulsified intermediary Host itself.**—*13th & 14th Reps. Vet. Res. S. Afr.*, pt. i, pp. 15–44. Pretoria, October 1928.

This account of the transmission of heartwater, caused by *Rickettsia ruminantium*, to sheep by the intrajugular injection of emulsions of nymphs of *Amblyomma hebraeum*, Koch, fed as larvae on infected cattle, and of African coast fever, caused by *Theileria parva*, to cattle by the intrajugular injection of emulsions of nymphs and adults of *Rhipicephalus appendiculatus*, Neum., fed on infected cattle in the previous stage [*R.A.E.*, B, xv, 29, 127], includes the results of further experiments. Using emulsions of nymphs of *A. hebraeum* that had been fed for 8–10 days on a calf just previously, four sheep were infected by injection of from 0·1 to 5 c.c. emulsion containing one nymph per c.c., but a negative result was obtained from the injection of 0·01 c.c. Negative results were also obtained in ten further cases with emulsions of unfed infective nymphs of *A. hebraeum*, and in a series of experiments with fed and unfed nymphs in which the emulsion was made in a solution of 50 per cent. glycerine and 50 per cent. normal saline instead of in saline alone.

In four further experiments with adults of *R. appendiculatus* fed for 72 hours or longer, negative results were obtained with intrajugular injections of emulsions, although all the ticks proved to be infective to the cattle on which they fed; these ticks were all 144 or more days old, and those used in the one previous positive experiment were only 16 days old, so that the age of the ticks was apparently the factor that determined whether the emulsions were infective or not. In further experiments with fed nymphs of *R. appendiculatus*, all of which proved infective when fed on susceptible cattle, some positive and some negative results were obtained; the emulsion of nymphs fed for 72–96 hours injected intrajugularly proved to be infective for five animals out of nine. The failures were all in a batch that had been fed for exactly 72 hours, the time probably being too short. Nymphs fed for 96 hours or longer proved to be infective in only two out of nine cases. The age of the nymphs apparently did not affect the infectivity of the emulsions.

Curson (H. H.). **Nagana in Zululand.**—*13th & 14th Reps. Vet. Res. S. Afr.*, pt. i, pp. 307–412, 20 pls., 3 maps, 8 diagr., 43 refs. Pretoria, October 1928.

This is an account of an investigation of trypanosomiasis (nagana) of domestic animals in Zululand, made from 1921 to 1923. The history and distribution of the disease, the diagnosis and differentiation of the species of trypanosomes encountered, and their symptomatology, including transmission experiments carried out by inoculation, the use of drugs to control the disease and some miscellaneous experiments are dealt with. The entomological aspects of the investigation have, for the most part, been discussed in separate papers [*R.A.E.*, B, xii, 116; xv, 88; xvii, 36. *Cf.* also xvi, 129].

Trypanosoma congolense was found to be responsible for the vast majority of cases of nagana, particularly in cattle, in which it assumed a sub-acute form; in other domestic animals it generally assumed a chronic form. *T. brucei* assumed an acute form in dogs, cats (artificial infection only) and horses, a sub-acute form in mules, donkeys, sheep and goats, and a chronic form in pigs and cattle; no cases of natural infection with *T. brucei* were observed by the author in sheep, goats or pigs, although they apparently occur, and no unmixed natural infection in cattle was seen. *T. vivax* was met with on eighteen occasions in cattle, and not in any other domestic animals; in three untreated animals the disease terminated fatally after a fairly rapid course; nine others apparently recovered.

No record exists of man ever having contracted sleeping-sickness in Zululand. Thousands of people there are bitten by *Glossina* every year without any illness resulting. Experiments to show that *T. brucei* is not pathogenic to man were carried out by inoculating blood from an infected horse into a European and two natives. These individuals remained well, and no trypanosomes were found in their blood; sub-inoculations from the European and one of the natives made a month later into a dog and a white rat in each case gave negative results.

An investigation was made to determine what game animals may serve as reservoirs of nagana. Of 63 animals killed, only a wart-hog and a duiker, which harboured trypanosomes believed to be *T. vivax*, were found by blood examination to be infected. Sub-inoculation of blood into laboratory animals gave negative results in all cases.

Viljoen (P. R.), Curson (H. H.) & Fourie (P. J. J.). **Anthrax in South Africa. With special Reference to improved Methods of protective Inoculation.**—*13th & 14th Reps. Vet. Res. S. Afr.*, pt. i, pp. 429–531, 2 pls., 2 maps, 8 figs., 29 refs. Pretoria, October 1928.

Anthrax is widespread and very prevalent in the Transvaal, Orange Free State, Natal and the eastern part of Cape Province, particularly Griqualand West and Transkei. The common horsefly, *Hippobosca rufipes*, Olf., is also widespread in South Africa, and is particularly abundant in some of the drier areas, such as Griqualand West and the western part of the Orange Free State. The flies, which are found almost throughout the year, but are most numerous in the spring and early summer, show a marked preference for horses as compared with cattle and sheep, and settle in large numbers on the parts of the body that are not well protected by hair. *Bacillus anthracis* has been isolated from individuals of *H. rufipes* removed from cattle infected

with anthrax, and recent observations provide strong evidence that the disease is transmitted by this Hippoboscid.

Only horses are extensively attacked by *H. rufipes*, and the disease is largely confined to these animals, even when cattle and sheep are running with them. The anthrax swellings have been observed to begin on parts of the body on which the flies congregate. The disease occurs in an epizootic form only when the flies appear in swarms on the animals, *i.e.*, in summer. The horsefly feeds slowly, remaining on its host for long periods, and apparently mechanical transmission is possible only when the flies are numerous. An outbreak usually starts in a sporadic manner, only a few animals being affected ; the flies, which infest the diseased horses in particular, then apparently convey the infection to healthy ones, so that it is not unusual for 50–60 per cent. of the horses on a farm to succumb in a few weeks. The fact that the horses have to congregate at one or two places for water adds to the opportunities of the flies for transmitting infection.

BEDFORD (G. A. H.). **The Effect of various Dipping Fluids upon the ovigerous Females of** *Psoroptes communis* **var.** *ovis* **and their Ova.**— *13th & 14th Reps. Vet. Res. S. Afr.*, pt. ii, pp. 859–879, 1 fig., 1 ref. Pretoria, October 1928.

This is a report on a series of experiments carried out on a large scale to test the effectiveness against *Psoroptes ovis*, Hering, on sheep of home-made lime-sulphur and a number of proprietary dips extensively used in South Africa. The tests were carried out because of the continued failure of some farmers to free their sheep from infestation, in spite of the fact that previous experiments [*R.A.E.*, B, iv, 189] had shown that so far as could be ascertained a single immersion in any of these fluids almost invariably cured the sheep of scab. Many failures to eradicate scab have doubtless been due to faulty methods, but it is probable that most of them have been due to the sheep becoming reinfested after dipping and to other causes.

The following is largely taken from the author's summary and conclusions :—

None of the dipping fluids, with the exception of one proprietary one, killed eggs of *P. ovis* dipped in them *in vitro* for 2–20 minutes ; consequently they will not destroy eggs that are laid on sheep a day or two before the animals are dipped. However, with the majority of the dips this is of no importance, since the larvae are killed within a few hours after hatching by the fluids that remain in the wool of the sheep. The only dips that failed to destroy all the larvae after hatching were two proprietary nicotine fluids and lime-sulphur, and these killed the majority. Eggs dipped in the various fluids *in vitro* and then placed on dipped sheep always took 3–4 days to hatch instead of the normal 2–3.

Ovigerous females of *P. ovis* survived immersion *in vitro* for 10 minutes in lime-sulphur and for 2 minutes in soda-sulphur and all but two of the proprietary dips, and subsequently laid viable eggs on undipped sheep.

Some of the experiments clearly show that certain dips afford protection to sheep against scab for longer than others ; this is an important factor, especially if sheep are kept in infested places after dipping. Moreover, the chance of a mite being able to survive on an animal after it has been immersed in a fluid that does not protect it against scab after dipping is naturally greater ; this would apply particularly in the case of a mite living under a crust at the time of dipping and leaving it a few days later.

Badly infested animals lose condition, and their wool becomes thin and is frequently lost entirely in places ; it is consequently easy for the dip to reach the mites on such animals. With sheep that are only slightly infested, however, the wool may be sufficiently long and thick to protect the mites.

Infestation may start anywhere on the sheep where there is wool, but as a rule it starts on the body, and if not checked may spread to the head and ears. As it is only possible to immerse the heads of the animals for a few seconds, it is quite likely that infestation on the head has in many instances been responsible for failure to cure scab. It has not hitherto been generally known that *P. ovis* can infest the ears of sheep, but such infestation was found in a large number of cases, including three in which the mites were not present on the head or body.

All sheep should be shorn before being dipped, unless they have very fine and loose wool, and crusts on the bodies of infested animals should be removed by brushing the sheep with a brush steeped in a mixture of 2 parts oil and 1 part paraffin. The ears of all sheep in an infested flock should be treated, before each of the two dippings, with a mixture either of 2 parts Stockholm tar, 2 parts oil and 1 part turpentine, or of 2 parts oil and 1 part paraffin. The mixture may be applied with a piece of rag or cotton-wool bound round the end of a stick pointed like a pencil. Crusts, if present in the ears, should first be removed with forceps. The ears should be squeezed when the mop has been placed inside them.

Sheep should be kept in the tank for a full two minutes, during which time their heads should be immersed two or three times. The second dipping should be given 9–10 days after the first. After dipping, the animals should not be returned to previously infested ground for 16 days or longer.

The lime-sulphur dip has proved very satisfactory on the whole in practice in South Africa, but it does not protect sheep against infestation to any great extent, and should not be used if the animals are to be kept in infested places after dipping. Mites placed on sheep dipped in lime-sulphur 24 and 48 hours after the animals had been immersed for 2 minutes mostly survived.

Bedford (G. A. H.). **South African Mosquitoes.**—*13th & 14th Reps. Vet. Res. S. Afr.*, pt. ii, pp. 881–990, 22 figs., 43 refs. Pretoria, October 1928.

The object of this paper is to bring together the available information on the mosquitos of South Africa that has hitherto been obtainable only by consulting numerous scattered works. The general morphology of the adult and immature stages of mosquitos is described, and keys, mostly based on those of Edwards, are given to the adults and some larvae. Descriptions are given of the adults of all the species, with the more important bibliographical references and notes on their distribution, and, where known, their seasonal prevalence, breeding-places and economic importance. The Anophelines dealt with that are not recorded by Ingram & De Meillon [*R.A.E.*, B, xvi, 124] are *Anopheles argenteolobatus*, Gough, *A. jacobi*, Hill & Haydon, *A. nili*, Theo., *A. pitchfordi*, Giles, and *A. marshalli*, Theo. In an addendum, notes are given on additional species of mosquitos described or recorded by Ingram & De Meillon [*loc. cit.*].

Report of the Second International Conference on Sleeping-sickness held in Paris, November 5th to 7th, 1928.—90 pp., 3 maps. Geneva, League of Nations Health Organisation (C.H. 743), December 1928.

This report includes a brief summary of the proceedings of the Conference, with the recommendations adopted, a report on human trypanosomiasis in the Belgian Congo submitted by the Belgian Ministry of the Colonies, a memorandum submitted by the British Colonial Office, a report on the campaign against sleeping-sickness in the French Colonies and Mandated Territories, submitted by the French Ministry of the Colonies, and an account of the organisation and administration of measures against sleeping-sickness in Fernando Po and Spanish Guinea, submitted by the Directorate-General for Morocco and the Colonies of Spain. In a report by G. H. Maurice on sleeping-sickness in the Anglo-Egyptian Sudan (pp. 55–58), it is stated that the area infested with *Glossina palpalis*, R.-D., in that country consists of a belt not more than 200 miles wide, extending along the southern frontier for about 1,000 miles, from the junction of the Bahr-el-Ghazal and Darfur provinces, about latitude 9° 30′ N., to a point in Mongalla province east of the Nile on the Uganda frontier, about latitude 4° 30′ N. A serious outbreak of sleeping-sickness in Bahr-el-Ghazal occurred in 1918, but between 1923 and 1928 the epidemic was stamped out by segregation of infected persons and concentration of the population to allow frequent inspection and the clearing of places where water is obtained. Smaller outbreaks in Mongalla had been eradicated by 1924, and the country is now free from the disease, except for sporadic cases traceable to infection from outside.

The Conference adopted, with slight modifications, the recommendations for the control of sleeping-sickness made by the International Commission [*R.A.E.*, B, xvii, 47] and also recommended that further study should be carried out in national laboratories of the various countries in Africa on a number of problems, which are enumerated. The memorandum submitted by the British Colonial Office (pp. 35–54) contains an account of the progress of investigation in recent years on the bionomics and control of *Glossina* and the treatment and diagnosis of sleeping-sickness, in addition to a report on the position with regard to sleeping-sickness questions in the British Colonies and Protectorates in 1925 and the progress made in that and following years.

Nieschulz (O.). **Zoologische Beiträge zum Surraproblem. xxi. Weitere Surraübertragungsversuche mit** *Tabanus striatus* **Fabr. und** *T. rubidus* **Wied.** [Zoological Contributions to the Problem of Surra. xxi. Further Surra Transmission Experiments with *T. striatus* and *T. rubidus*.]—*Arch. Protistenk.*, lxv, no. 1–2, pp. 78–96, 1 fig., 9 refs. Jena, 31st January 1929.

Further experiments are described on the transmission of surra by *Tabanus rubidus*, Wied., and *T. striatus*, F. [*R.A.E.*, B, xvi, 109], using horses, guineapigs and monkeys. Comparisons showed *T. rubidus* to be the more efficient vector, whatever the interval elapsing between the the biting of the infected animal and the healthy one.

Newman (L. J.). **Report of Economic Entomologist.**—*Ann. Rep. Dept. Agric. W. Aust. 1927–28*, pp. 28–30. Perth, W.A., 1928.

Two generations of the blow-fly parasite, *Alysia manducator*, Panz., have been successfully reared in Western Australia from material

received from the Imperial Bureau of Entomology. A local Encyrtid parasite, *Stenoterys* sp., which promises to be very useful, has been discovered in the course of this work. In order to prevent the spread of *Lyperosia exigua*, de Meij. (buffalo fly), the landing of manure from steamers carrying cattle from the north-west has been prohibited unless the boat is declared free from the fly before leaving the port of shipment.

The Sheep Blowfly. Cause, Effect, Prevention, and Treatment of Cutaneous Myiasis.—*Agric. Gaz. N.S.W.*, xxxix, pts. 11 & 12, pp. 795-807 & 927-937, 3 figs. Sydney, 1st November & 1st December 1928.

A brief account is given of the biology of the blow-flies that infest sheep in New South Wales, with a summary of the conclusions so far reached by the officers of the State Department of Agriculture with regard to the problem and the methods of dealing with it.

Notes are given on the duration of the immature stages of *Chrysomyia albiceps*, Wied., *Anastellorhina* (*Calliphora*) *augur*, F., *Pollenia* (*C.*) *stygia*, F., *Chrysomyia* (*Microcalliphora*) *varipes*, Macq., and *Lucilia sericata*, Mg. It has been found that the abundance of these blow-flies is dependent on climate and topography. Inland areas may be almost entirely free from blow-flies during the winter, whereas near the coast they are always present in appreciable numbers. At high altitudes, there is a tendency for blow-flies to be abundant at two isolated periods of the year; at low altitudes, inland, there is one period of several months during which they are abundant. *C. albiceps* is predominant in summer (November to March), its place being taken in winter by *A. augur* or *P. stygia*. *A. augur* appears to be the species most susceptible to changes of temperature, humidity, etc. A high rainfall in summer produces a rapid increase in the numbers of *C. albiceps*, and a low rainfall a corresponding decrease. *P. stygia* is apparently almost unaffected by climatic changes, and is abundant in winter, disappearing almost entirely in summer. *L. sericata* and *C. varipes* are most numerous in the spring.

Abundance of blow-flies is not necessarily accompanied by severe infestation of sheep; a period of severe attack may occur when the flies are comparatively few. *L. sericata* has been found to be the species most injurious to sheep.

Sheep may become infested with blow-fly larvae in any wound, but in Australia the great bulk of the infestation is on sheep that have not been injured in any way. The principal factors predisposing to attack are conformation that allows staining of the crutch and the retention of the skin secretions of that part; soiling of the crutch by excreta; presence of wool so long that, at least near the skin, it does not become dry; and any other special cause, such as lambing, scouring, etc., that produces soiling of the crutch. The presence of blow-fly larvae under the wool produces a blackish exudate, the odour of which attracts other blow-flies, so that the infestation increases if the animals are not treated. The larvae sometimes travel 3-4 inches to fresh wool from their original position. The lesions caused by the various species vary in severity, those produced by *L. sericata* spreading most rapidly and causing the most extensive wounds.

Large scale experiments to compare the efficiency of the old Australian type of blow-fly trap, with the entrance at the top, and the South African type (*R.A.E.*, B, xii, 19-21), with entrances at the sides, showed

the latter to be much the more effective. While the tests were in progress, however, a still more effective trap was devised in Western Australia [xv, 11]. The construction of this last type is described.

Mention is made of several Hymenopterous parasites of blow-flies that occur in Australia. One of these, the Chalcid, *Mormoniella vitripennis*, Wlk. (*brevicornis*, Ashm.), was formerly distributed in very large numbers from insectaries in New South Wales, but has exercised no appreciable control over the blow-flies. In 1926, the Braconid, *Alysia manducator*, Panz., was imported from England. In the laboratory, this parasite developed in the smooth-bodied larvae of *L. sericata*, but the tough-skinned, hairy larvae of *C. albiceps* were not successfully parasitised, although the females attempted to oviposit in them [but *cf. R.A.E.*, B, xvi, 81]. Further introductions of *A. manducator* were made in 1928, and some of the parasites were liberated in the open.

The methods of treating sheep, by crutching, jetting, etc., to prevent them from becoming infested, and the methods of treating infested sheep, are discussed. A dressing for application to infested parts should destroy the blow-fly larvae without injuring the sheep or the wool, be soothing and healing to the wounds, adhere to the wool and skin, and be repellent to flies, thus preventing re-infestation for a reasonable time. Experiments to determine the best type of dressing are in progress. There is reason to believe that the most effective substances for repelling the flies are not highly odorous or irritating, but materials that can absorb or inhibit the formation of the volatile compounds evolved by decomposing meat. Chemical notes are given on a number of organic and inorganic materials that are constituents of proprietary and other preparations for use against blow-flies.

BARANOFF (N.) & JEŽIĆ (J.). **Fliegenmaden als Wundschmarotzer bei den Haustieren in Südserbien.** [Maggots infesting Wounds of Domestic Animals in South Serbia.]—*Z. Parasitenk.*, i, pt. 3, pp. 416–422, 4 figs., 3 refs. Berlin, 1928.

This is an account of observations made in 1927 in South Serbia on domestic animals infested by the larvae of various flies. In the majority of cases the larvae extracted from the lesions were those of *Wohlfahrtia magnifica*, Schin.; larvae of *Sarcophaga* (*Bellieria*) *securifera*, Villen., and *S.* (*B.*) *falculata*, Pand., occurred only in wounds already occupied by *W. magnifica*. The characters of these three flies are described in detail. The larvae apparently only occur on diseased animals, and were never found on healthy ones. The larvae of *S. falculata* develop more quickly than those of *W. magnifica*, and when both these species occur together, the latter die in spite of an abundance of food.

[PAVLOVSKIĬ (E. N.).] **Павловский (Е. Н.). The Importance of the Control of *Hypoderma* in U.S.S.R.** [*In Russian.*]—*Prakt. Vet.*, v, no. 12, pp. 58–66, 7 refs. Moscow, December 1928.

A brief review is given of the losses caused among domestic animals in Russia through the attacks of various Arthropods, with notes on the habits of *Cephalomyia* (*Oestrus*) *ovis*, L., attacking sheep, *Rhinoestrus purpureus*, Br., attacking sheep and horses, and *Oestrus* (*Gastrophilus*). The latter is a very important parasite of horses, as the larvae developing in the stomach of the host cause severe anaemia. Experiments showed

that they contain toxic elements, as a single injection of an emulsion of only four larvae from the body of a horse that had died from anaemia killed a healthy horse in 12 minutes, while extracts prepared from "healthy" larvae killed a horse within two days.

The infestation of cattle by *Hypoderma bovis*, DeG., and *H. lineatum*, Vill., is discussed in detail. Young animals are more often attacked than older ones ; the latter eventually become immunised by the body fluids of the larvae that die while migrating in them. The milk production of infested cows decreases by 10 to 25 per cent. or more, whereas the extraction of the larvae from the skin immediately results in an increase in the yield of the milk. The statistics of hide production in Russia are briefly discussed, and the great losses caused to this branch of the export trade by the larvae of *Hypoderma* are pointed out.

Goetghebuer (M.). **Note sur un cas de myase intestinale.**—*Bull. Ann. Soc. ent. Belg.*, lxviii, no. 11–12, pp. 237–239, 1 ref. Brussels, February 1929.

A case of severe intestinal myiasis recorded in Belgium is described. It was found to be due to larvae of *Fannia scalaris*, F., and the Ephydrid, *Teichomyza fusca*, Macq., though attempts to rear adults from them failed.

Ouzilleau (F.). **Un cas de myiase urinaire.**—*Bull. Soc. Path. exot.*, xxi, no. 10, pp. 852–853. Paris, December 1928.

A case of urinary myiasis in man, caused by the larva of *Fannia* (*Anthomyia*) *canicularis*, L., is recorded from Maisons-Lafitte, France. A note by Roubaud states that two or three similar cases have come to his notice in the neighbourhood of Paris during the last fifteen years.

Coutelen (F.). **Parasitisme et Thysanoures.**—*Bull. Soc. Path. exot.*, xxi, no. 10, pp. 853–855, 3 refs. Paris, December 1928.

The author records several cases, one of which he has observed himself, of Apterygota (in the instance under observation, of the Collembolan, *Lepidocyrtus curvicollis*, Bourlet) infesting the human scalp, the infestation in one case being chronic. These insects are found in every degree of adaptation to parasitic life, from simple commensalism in the nests of ants to infestation of the caps of mushrooms in hotbeds. The cases recorded are not considered to be cases of true parasitism ; the persons in question lived in the country and evidently re-infested themselves regularly in the course of their occupations. The insects perhaps feed on the scurf on the head, as they have never been known to cause any lesion.

Papers noticed by Title only.

[Pavlovskiĭ (E. N.) & Stein (A. K.).] **Павловский (Е. Н.) и Штейн (А. К.). Uber die giftigen Eigenschaften der wirksamen Bestandteile des Käfers *Paederus fuscipes* (Fam. Staphylinidae) in Bezug auf die Menschenhaut.** [On the Action of the poisonous Elements of *Paederus fuscipes* in Relation to the Skin of Man.]—*Z. Parasitenk.*, i, pt. 3, pp. 476–483, 5 refs. Berlin, 1928. *In Russian* in *Zhurn. eksper. Biol. Meditz.*, x, no. 27, pp. 440–447, 5 refs. Moscow, 1928.

[Pavlovskiĭ] Pawlowsky (E. N.), Stein (A. K.) & [Perfil'ev] Perfiljew (P. P.). **Experimentelle Untersuchungen über die Wirkung der wirksamen Bestandteile der Mücke** *Culex pipiens* **auf die Menschenhaut.** [Experimental Investigations on the Effect of the active Elements of *Culex pipiens* on the Human Skin.]—*Z. Parasitenk.*, i, pt. 3, pp. 484–488. Berlin, 1928. [*See R.A.E.*, B, xvii, 24.]

Vogel (R.). *Aëdes pulchritarsis* **Rondani (Culicidae) ein Baumhöhlenbrüter.** [*A. pulchritarsis*, a Tree-hole Breeder (Larva and Pupa described).]—*Int. Rev. Hydrobiol.*, xxi, no. 3–4, pp. 161–170, 8 figs., 6 refs. Leipzig, 1929.

Schwetz [J.] & Edwards (F. W.). **Synopsis des moustiques connus du Congo belge, avec quelques commentaires et considérations.**—*Rev. zool. afr.*, xv, pt. 3, pp. 271–319, 42 refs. [Brussels] 15th September 1927.

Schouteden (H.). **Quelques moustiques congolais.** [Lists supplementary to the preceding paper.]—*Rev. Zool. Bot. afr.*, xvi, pt. 3, pp. 335–336. [Brussels] 15th December 1928.

Edwards (F. W.). **A new Mosquito from the Kivu Volcanoes, Belgian Congo.**—*Rev. Zool. Bot. afr.*, xvi, pt. 3, pp. 324–325, 1 fig. [Brussels] 15th December 1928.

Goetghebuer (M.). **Deux formes nouvelles de Ceratopogonidae de Belgique.**—*Bull. Ann. Soc. ent. Belg.*, lxviii, no. 11–12, pp. 232–234. Brussels, February 1929.

[Perfil'ev] Perfiljew (P. P.). **Zur vergleichenden Anatomie von** *Phlebotomus* **(Dipt. Psych.).** [The comparative Anatomy of *Phlebotomus*.]—*Z. Parasitenk.*, i, pt. 3, pp. 438–475, 36 figs., 19 refs. Berlin, 1928.

Enderlein (G.). **Ueber die Klassifikation der Stomoxinae (blutsaugende Musciden) und neue Arten aus Europa und Afrika.** [On the Classification of the Stomoxinae (blood-sucking Muscids) and new Species from Europe and Africa.]—*Z. angew. Ent.*, xiv, pt. 2, pp. 356–368, 15 figs. Berlin, November 1928.

Bedford (G. A. H.). **New Species of Trichodectidae from South African Mammals** [8 spp. n.].—*13th & 14th Reps. Vet. Res. S. Afr.*, pt. ii, pp. 839–857, 16 figs. Pretoria, October 1928.

Fourie (P. J. J.). **A Case of Demodectic Mange in the Goat.**—*13th & 14th Reps. Vet. Res. S. Afr.*, pt. i, pp. 627–631, 3 figs., 6 refs. Pretoria, October 1928. [See *R.A.E.*, B, xv, 127.]

Jordan (K.). **Notes on North American Fleas** [1 new Genus, 10 new Species and 11 new Subspecies].—*Nov. Zool.*, xxxv, no. 1, pp. 28–39, 2 pls. Tring, 25th January 1929.

Jordan (K.). **Some Old-World Siphonaptera** [2 new Species and 1 new Subspecies].—*Nov. Zool.*, xxxv, no. 1, pp. 40–41, 3 figs. Tring, 25th January 1929.

Jordan (K.). **Further Records of North American Bird-fleas, with a List of the Nearctic Birds from which Fleas are known.**—*Nov. Zool.*, xxxv, no. 1, pp. 89–92. Tring, 25th January 1929.

Schulze (P.). **Formenkreis: Zecken, Ixodoides.** [The Fauna of Central Europe: Ticks.]—*Die Tierwelt Mitteleuropas*, iii, 4, pp. X1–X10, 36 figs. Leipzig, 1928.

Sergent (Edm.), Donatien (A.), Parrot (L.) & Lestoquard (F.). **Tiques et piroplasmoses bovines d'Algérie. Première note.**—*Bull. Soc. Path. exot.*, xxi, no. 10, pp. 846-849, 1 ref. Paris, December 1928.

In the experiments described with ticks taken in Algeria, true piroplasmosis (*Piroplasma bigeminum*) and anaplasmosis (*Anaplasma marginale*) were transmitted to cattle by *Rhipicephalus bursa*, C. & F., *Babesiella berbera* by *Boophilus* (*Margaropus*) *annulatus calcaratus*, Bir., *Theileria dispar* by *Hyalomma mauritanicum*, Senevet, and anaplasmosis by *H. lusitanicum*, Koch. In the last case the infection was transmitted by adult ticks that had been bred from infected parents but had not transmitted the disease in their earlier stages, and in the case of *Boophilus annulatus calcaratus* transmitting *B. berbera*, the infection was caused by larvae bred from infected adults.

Boycott (A. E.). **Reaction to Insect Bites.**—*Univ. Coll. Hosp. Mag.*, xiii, p. 200. London, 1928. (Abstract in *Lancet*, ccxv, no. 5494, p. 1253. London, 15th December 1928.)

Experiments were carried out in London with specimens of *Phlebotomus papatasii*, Scop., bred from larvae sent from Jerusalem, to discover the effect of the bites of this sandfly on persons who, having never been out of England, had never been exposed to its bites previously. The first bites of the sandflies on four such people produced no reaction; one gave a doubtful positive reaction when bitten again two days later, and a violent reaction when bitten a third time, 7 days after the first; one gave a marked reaction to a second biting on the tenth day; one was negative on the seventh day and positive on the twelfth day; one was negative on the third and seventh days and strongly positive on the thirteenth and nineteenth days. All four, therefore, became sensitive and gave typical reactions, which are hard wheals that are very irritable and last as long as a fortnight. In an individual who had been freely exposed to the bites of *P. papatasii* in the East ten years previously, the first bites of sandflies in London were followed immediately by wheals. From these experiments it seems likely that the period that must elapse before the subject becomes sensitive is about 7–10 days, an interval that is in accord with the interpretation of the reaction as an anaphylactic phenomenon. It was noticed that a second biting on another part of the body, ten days after the first, might cause marked wheals to appear at the site of the first bites.

Adler (S.) & Theodor (O.). **Observations on *Leishmania ceramodactyli* n. sp.**—*Trans. R. Soc. Trop. Med. & Hyg.*, xxii, no. 4, pp. 343-356, 1 fig., 11 refs. London, 30th January 1929.

Leishmania ceramodactyli, sp. n., is described from geckos (*Ceramodactylus doriae*) caught in or near houses in Baghdad. The flagellate was obtained in cultures of blood drawn with a fine capillary tube from the heart of the gecko, and also in a number of individuals of *Phlebotomus papatasii*, Scop., and one of *P. minutus*, Rond., fed on infected geckos.

L. ceramodactyli developed rapidly in *P. papatasii* when the sandflies had fed either on infected geckos or on cultures. The flagellates

(3578) Wt P4/3520 1,750 5/29 H & Sp Gp 52

typically occupy a posterior position in the sandfly, only occurring in the cardia when the infection is very heavy in the stomach. It seems probable that *P. papatasii* is the natural vector of *L. ceramodactyli*, and that infection is brought about by the gecko swallowing an infected sandfly ; infection of the vertebrate host by the mouth occurs with most flagellates that adopt a posterior position in their insect host.

The behaviour of two strains of *Leishmania tarentolae* [from North Africa] in *P. papatasii* was studied, and serological comparisons of *L. tarentolae* with *L. ceramodactyli* were made. In both strains of *L. tarentolae* the flagellates tended to adopt an anterior position in the sandflies. No group agglutinations were found to be common to *L. ceramodactyli* and *L. tarentolae* ; the former sohwed no cross-agglutinations with *L. donovani*, *L. infantum*, *L. brasiliensis* or *L. tropica*, whereas *L. tarentolae* showed a most marked cross-agglutination with Mediterranean strains of *L. infantum*. This fact and the similarity between the behaviour of *L. tarentolae* and some strains of *L. infantum* in *P. papatasii* indicate that the theory of the gecko serving as a reservoir of human leishmaniasis [*R.A.E.*, B, ii, 199 ; iii, 230] should be investigated further. The original hypothesis [*loc. cit.*] was that the gecko was a reservoir of *L. tropica*, but Wenyon has recently suggested that it might be a reservoir of *L. infantum*. In Baghdad, which is probably the largest focus of oriental sore (*L. tropica*), the authors found no evidence that geckos are a reservoir, and in Aleppo they are very scarce.

Biologically, *L. ceramodactyli* represents an intermediate stage between the species of *Herpetomonas* that are purely parasites of insects and the species of *Leishmania* that are parasites mainly of endothelial cells of vertebrates. The former undergo a multiplication stage in the stomach and hind-gut of the insects, they have in the hind-gut both free flagellates and forms attached to the chitinous intima, they show a typical posterior position in the insect and they pass from insect to insect by means of cysts ejected in the faeces. The species of *Leishmania* parasitic in the blood of vertebrates that had previously been studied show a typical anterior position in sandflies, for example, *L. tropica* in *P. papatasii* and *P. sergenti*, Parrot, and *L. donovani* in *P. argentipes*, Ann. & Brun. *L. infantum*, *L. caninum*, *L. brasiliensis* and *L. tarentolae*, when introduced in sufficiently large numbers into *P. papatasii*, either remain and multiply in the stomach, or in heavy infections ascend the cardia ; in no case do they acquire a posterior position.

Escomel (E.). **La leishmaniose américaine et les leishmanioses en Amérique.**—*Bull. Soc. Path. exot.*, xxii, no. 1, pp. 35–46, 8 pls., 1 ref. Paris, 1929.

The differences between American leishmaniasis and oriental sore, and several other diseases produced by various pathogenic organisms that resemble it clinically, are discussed. The author considers that the vector of American leishmaniasis is a slow-moving Arthropod, which may be a mite, possibly *Leptus japa*, Ribeyro & Bambarén. The two forms of American leishmaniasis, " uta," which predominates at higher altitudes, and " espundia," which predominates in the tropical forest areas, are compared, and their distribution is discussed [*cf. R.A.E.*, B, xv, 159].

Bouffard (G.) & Legac (P.). **Myiase à *Chrysomyia bezzianum* observée chez un indigène de la Côte d'Ivoire.**—*Bull. Soc. Path. exot.*, xxii, no. 1, pp. 48–49. Paris, 1929.

A case of myiasis in an African native in the Ivory Coast is described, in which 163 larvae of *Chrysomyia bezziana*, Villen., were removed from a wound in the face. This is believed to be the first record of human myiasis caused by this Calliphorid in Africa.

Motais [F.] & Borel [E.]. **Un cas de myiase de la région temporo-orbitaire gauche.**—*Bull. Soc. méd.-chir. Indochine*, vi, pp. 309–317. 1928. (Abstract in *Bull. Inst. Pasteur*, xxvii, no. 5, p. 239. Paris, 15th March 1929.)

A case of ocular myiasis caused by *Chrysomyia bezziana*, Villen., in a native of Tonkin is recorded; 96 larvae were removed from the wound and reared to the adult stage on banana.

Sticker (G.). **Ein Fall von Hautmaulwurf aus Guatemala.** [A Case of cutaneous Myiasis from Guatemala.]—*Verh. phys.-med. Ges. Würzburg*, liii, no. 1, pp. 40–54, 4 figs. Würzburg, 1928.

A case of myiasis caused by *Dermatobia hominis*, Say (*cyaniventris*, Macq.) is recorded from Guatemala. The eggs, to the number of 900, are laid on the body of mosquitos or other blood-sucking insects, whence the larvae, which are ready to hatch in 6 days, are transferred to the skin of man and other mammals. They bore into and under the skin, where they remain 5–10 weeks, according to the temperature, when they pupate in the ground. The pupal stage lasts 5–11 weeks.

The California Eye Gnat.—*Science*, lxix, no. 1783, suppl., p. xiv. New York, N.Y., 1st March 1929.

It is recorded that 15,000 school children at Thermal, California, are suffering from pink eye [catarrhal conjunctivitis], caused by *Hippelates pusio*, Lw., which has increased alarmingly there in the last five years. It hovers in swarms about the eyes, nose and mouth of man and animals. Its breeding-places have not yet been discovered [*R.A.E.*, B, xvii, 54]. Unless it is controlled, it will render that part of the country uninhabitable.

Howard (L. O.). **Report [1926-27] of the Entomologist.**—29 pp. Washington, D.C., U.S. Dept. Agric., 1927. [Recd. 9th March 1929.]

Marlatt (C. L.). **Report [1927-28] of the Entomologist.**—34 pp. Washington, D.C., U.S. Dept. Agric., 1928. [Recd. 8th February 1929.]

Tests made with powders applied to the backs of cattle to destroy cattle grubs [*Hypoderma bovis*, DeG., and *H. lineatum*, Vill.] without any preliminary treatment, indicate that certain tobacco powders of high nicotine content, free nicotine dust (1–3 per cent. nicotine), and powdered derris root give a high percentage of mortality if applied and brushed in at intervals of about 20 days. Home-made pyrethrum-kerosene extract used as a spray was shown to be very effective in

controlling the horn-fly [*Lyperosia irritans*, L.]. Although the stable-fly [*Stomoxys calcitrans*, L.] and the house-fly [*Musca domestica*, L.] were reduced in numbers, the inefficacy of fly sprays, except when used in conjunction with other control measures, was fully demonstrated.

COUSIN (G.). **Sur les conditions indispensables à la nutrition et à la ponte de** *Lucilia sericata*, **Meig.**—*C.R. Soc. Biol.*, c, no. 8, pp. 570–572. Paris, 1st March 1929.

Studies on the nutrition and oviposition of *Lucilia sericata*, Mg., showed that in order to rear normal individuals in the laboratory certain external conditions are necessary for the adults, *viz.* : a strong light to induce feeding ; the regular spraying of water on the walls of the cage to promote the absorption of water necessary to produce a physiological equilibrium ; a temperature that may vary within wide limits but is optimum between 25–30° C. [77–86° F.] ; and sufficient space to ensure flight.

COUSIN (G.). **L'alimentation de** *Lucilia sericata* **et ses relations avec la ponte.**—*C.R. Soc. Biol.*, c, no. 9, pp. 648–649. Paris, 8th March 1929.

A description is given of experiments undertaken to determine the influence of nutrition on *Lucilia sericata*, Mg. The conclusions arrived at are that a nucleo-proteic alimentation is necessary for the maturation of the eggs, and the introduction of carbohydrates into a flesh diet assures a better physiological equilibrium, its effect being particularly shown by a more regular egg-laying and a life of longer duration.

COUSIN (G.). **Sur le mode de ponte de** *Lucilia sericata* **Meig.**—*C.R. Soc. Biol.*, c, no. 10, pp. 731–732. Paris, 15th March 1929.

The pairing and oviposition of *Lucilia sericata*, Mg., are described, and the author draws the following conclusions from his experiments. Pairing takes place at rest and in the light. Eggs are laid immediately after, at irregular intervals and by successive stages, the females often dying before all the eggs are deposited. The number of times that a female oviposits varies from 2 to 5. The second of these is generally the most important.

COUSIN (G.). **Sur les relations entre l'accouplement et le réflexe de ponte de** *Lucilia sericata* **Meig.**
COUSIN (G.). **Sur les conditions extérieures déterminant le lieu de ponte de** *Lucilia sericata* **Meig.**—*C.R. Soc. Biol.*, c, no. 11, pp. 818–820 & 820–822. Paris, 8th April 1929.

The author concludes from his experiments that the maturation of the eggs and the reflex of egg-laying in *Lucilia sericata*, Mg., are independent of fertilisation. The eggs are laid irregularly, as in the case of fertilised females, but do not develop.

Physiological conditions determine the expulsion of the eggs, the fly laying them where she feeds. Their expulsion is not the result of an olfactory stimulus, but merely that of the contact of the ovipositor with the medium or of other unknown stimuli, and has nothing to do with the instinct for the protection of the species.

Liberation of Blow Fly Parasites.—1 p. [Nelson, N.Z.]. Cawthron Institute [5th December 1928].

Since the arrival in New Zealand at the end of 1926 of blow-fly pupae parasitised by *Alysia manducator*, Panz., sent from England by the Imperial Bureau of Entomology, methods have been evolved by which this Braconid has been bred in large numbers [*R.A.E.*, B, xvii, 21]. Not only has it been possible to make extensive liberations of the parasite in New Zealand, but towards the end of 1928 a large consignment was sent to Australia.

Parker (H. L.) & Thompson (W. R.). **Contribution à la biologie des Chalcidiens entomophages.**—*Ann. Soc. ent. Fr.*, xcvii, pp. 425–465, 38 refs. Paris, 1928.

Notes are given on the bionomics of twelve Chalcid parasites, as observed in France, including *Mormoniella vitripennis*, Wlk. (*brevicornis*, Ashm.), bred from the pupae of *Sarcophaga*, *Lucilia*, *Calliphora* and *Musca*, and *Spalangia* sp. from the pupae of *Musca domestica*, L., and *Sarcophaga*.

Ewing (H. E.). **Three new American Chiggers (Acarina : Trombidiidae).**—*Proc. Ent. Soc. Wash.*, xxxi, no. 1, pp. 9–11. Washington, D.C., 28th January, 1929.

The new mites, described from larvae, are *Trombicula shannoni* from a domestic cat, and *T. australis* from a lizard (*Tropiduras peruvianus*), both from Peru, and *T. oregonensis* from moles in Oregon.

Ainslie (C. N.). **Note on the Occurrence of the Mite, *Dermanyssus gallinae* L., in the Nest of a House Wren.**—*Canad. Ent.*, lxi, no. 2, pp. 39–40. Orillia, Ont., February 1929.

At Iowa, in the summer of 1927, the nest of a house wren, *Troglodytes aedon*, was found to be infested with the chicken mite, *Dermanyssus gallinae*, DeG. Although the nearest chicken pen was at least 100 ft. from the nest, sparrows, which mingle among fowls while they are being fed, had probably conveyed the mites to the nest, as they had frequently been observed trying to enter it. In the autumn the nest-box was disinfected, and the same pair of wrens occupied it in the spring of 1928. Mites were again found, though not in quite such numbers as in the previous year.

Oudemans (A. C.). [*Acarus* (**olim** *Sarcoptes*).]—*Tijdschr. Ent.*, lxix, Verslag pp. xix–xxvi. Amsterdam, 1926.

The author discusses some anatomical characters of the genus *Sarcoptes* (for which he adopts the name *Acarus*), and describes *S.* (*A.*) *bubulus*, sp. n., from cattle [in Holland].

Oudemans (A. C.). **Etude du genre *Notoedres* Railliet 1893 et de l'espèce *Acarus bubulus* Oudms. 1926.**—*Arch. néerland. Sci.*, Sér. 3B, iv, pt. 2, pp. 145–262, 85 figs. Haarlem, 1926.

The first part of this paper is a critical historical review of the synonymy of the genus *Notoedres* (*Notoedrus*) and the species belonging

to it, including *N. cati*, Hering (*minor*, Fürst., on cats, *notoedres*, Delaf. & Bourg.), which is the type and infests cats, *N. alepis*, Raill. & Lucet (*muris*, auct. nec Mégn., *notoedres*, auct. nec Delaf. & Bourg.), on *Mus rattus* and also on *M. norvegicus* (*decumanus*), *N. muris*, Mégn., on *M. norvegicus* and found once on *M. rattus*, *N. musculi*, Oudms., on *M. musculus*, *N. caniculi*, Gerl. (*minor*, Fürst., on rabbits, *cuniculi*, auct.), on rabbits, and several species to which no name is given. In the second part, detailed descriptions are given of the immature stages and adults of *N. cati*, *N. alepis*, *N. muris* and *N. musculi*, and in the third part a brief comparison of the morphology of the genus *Sarcoptes* (*Acarus*) with that of *Notoedres*.

The remainder of the paper deals with *Sarcoptes* (*Acarus*) *bubulus*, Oudms. (*bovis*, Cameron et auct., nec *Chorioptes* (*Sarcoptes*) *bovis*, van Leeuwen) from cattle in Holland. Detailed descriptions of the immature stages and adults and notes on the biology of this mite are given, and its morphology is compared with that of other forms of *Sarcoptes*, *viz.*, *equi*, Gerl., *ovis*, Mégn., *suis*, Mégn., *hydrochoeri*, Mégn., and *scabiei*, L. (for which the author adopts the name *siro*, L.). He considers these to be distinct species, although they are very similar morphologically.

Schwartz (B.) & Shook (W. B.). **Rabbit Parasites and Diseases.**—*Fmrs.' Bull. U.S. Dept. Agric.*, no. 1568, 30 pp., 23 figs., 1 ref. Washington, D.C., December 1928.

Rabbits in the United States are subject to infestation by four types of mange mites. Ear mange, commonly called " ear canker," is most frequently caused by *Psoroptes cuniculi*, Delaf., but sometimes by *Chorioptes cuniculi*, Zürn. The affection may penetrate to the middle ear, or even to the inner ear, and in exceptionally severe cases may cause death. *P. cuniculi* has been known to occur on the face, neck and legs. Treatment of rabbits for ear mange is relatively simple. A mixture of 20 parts olive oil and 1 part carbolic acid or cresol, or one of 25 parts olive oil, petroleum or cottonseed oil, 10 parts ether and 1 part iodoform, should be applied to the affected parts after the ear has been cleaned with hydrogen peroxide.

Skin mange, produced by *Sarcoptes scabiei cuniculi*, Neum., and *Notoedres caniculi*, Gerl. (*cuniculi*, auct.), occurs on the nose, lips, etc., and may spread to other parts of the body. Sarcoptic mange spreads very rapidly and is fatal in a few weeks if not checked. Treatment of skin mange is very difficult, and it is advisable to destroy the affected animals unless they are very valuable. The hutches should be disinfected with hot, strong coal-tar disinfectants. Rabbits from hutches adjoining those of affected animals should be isolated and kept under observation for several weeks. If treatment is undertaken, the hair should be clipped, and the exposed crusts should be softened by being rubbed with soft soap and a little warm water, the soap being washed off with warm water after an hour or two. Sulphur ointment, consisting of 1 part sulphur to 3–4 parts lard, or one of several other ointments, should be rubbed into the affected parts every 4–5 days.

The condition known as " wry neck " is sometimes associated with severe cases of ear mange, but is also said to be caused by accidental infestation of the ears by another mite, *Glyciphagus domesticus*, DeG., which is introduced into hutches in hay, straw, etc.

Rabbits kept under bad conditions, especially if weak and ill-nourished, are liable to infestation by *Haemodipsus ventricosus*, Denny (rabbit louse). Infested animals may be dusted with pyrethrum powder, which should be brushed out after about half an hour, or they may be treated by applying a vegetable oil, which should be removed after an hour or two with warm water and soap, or preferably with bran.

Fleas are apparently rare on domestic rabbits in the United States, with the exception of *Echidnophaga gallinacea*, Westw. (stick-tight flea), which is sometimes a serious pest of these animals in the Southern States. Infested animals should be treated in the same way as for lice; powdered naphthalene or derris may be used in place of pyrethrum. The hutches should be scalded with boiling water or sprayed with a good grade coal-tar creosote dip containing 10–16 per cent. tar acids.

The common American chigger mite, *Trombicula irritans*, Riley, and related species are known to attack wild rabbits, and will doubtless attack domestic ones; they may be introduced into hutches with grass or lawn clippings from infested areas. The vicinity of hutches should be kept free from rubbish and rank vegetation. Infestated animals may be treated with repeated applications of alcohol, and the itching may be alleviated by the application of solutions of ammonia or sodium bicarbonate.

Larvae of *Cuterebra cuniculi*, Clark, and related species are common in wild rabbits, and occur occasionally in domestic ones. They may be removed by enlarging the opening in the skin under which they occur, with a sterilised knife, and withdrawing them with forceps. The cavity should be swabbed with a 1 per cent. solution of cresol.

Domestic rabbits have been proved experimentally to be susceptible to tularaemia, although no cases of natural infection have been reported. Among wild rabbits the disease is transmitted by *Dermacentor venustus*, Banks (*andersoni*, Stiles) (wood tick), *Haemaphysalis leporis-palustris*, Pack. (rabbit tick), *Haemodipsus ventricosus*, and *Chrysops discalis*, Will. (deer fly). Man may become infected by the bites of *D. venustus* or *C. discalis*, or by handling the carcases of infected rabbits. If the disease occurs among rabbits, the animals should be destroyed.

Fletcher (T. B.) & Sen (S. K.). **A Veterinary Entomology for India.** —*J. Central Bur. Anim. Husb. Dairying India*, i, pts. 1–4, pp. 9–16, 69–81, 112–118, 175–177; ii, pts. 1–3, pp. 20–28, 64–74, 101–122, 8 pls., 30 figs., refs. Calcutta, April 1927–October 1928.

These are the first seven parts of a series in which it is proposed to summarise the present knowledge of insects affecting domestic animals in the Indian Region. It is estimated that the annual loss due to the attacks of insects and Arachnids on domestic animals in India is approximately £3,000,000. The first two parts are devoted to a discussion of the ways in which insects are injurious to animals, and include brief accounts of the life-cycles of some of the pathogenic organisms that are transmitted by insects. The term "setiasis" is proposed for injury caused by larvae of Lepidoptera boring in animal tissues, an instance of which is reported from Madras, where a large Cossid larva emerged from the frontal sinus of a bullock, after the amputation of a horn that had been broken. The five remaining parts contain short accounts of the morphology, metamorphosis and classification of insects, brief descriptions of the chief characters of the orders, and a more detailed account of the morphology of the Diptera.

Sugimoto (M.). **On the Pig Louse and Pig Louse Disease.** [*In Japanese.*]—*Bull. Dept. Agric. Res. Inst. Formosa*, no. 63, pp. 1–14, 3 pls. Taihoku, Formosa, October 1928.

Haematopinus suis, L., the adult of which is described, is very common on pigs in Formosa, sometimes causing serious injury. The eggs hatch in 12–15 days at temperatures of over 80° F. Spraying with kerosene emulsion or camphor oil are effective control measures.

Plague in China.—*Brit. Med. J.*, no. 3546, p. 1149. London, 22nd December 1928.

A serious local outbreak of bubonic plague occurred in northern Manchuria in the summer of 1928. The spread of the disease from the northern endemic focus of Outer Mongolia through Inner Mongolia to Manchuria was probably helped by the recent opening up of the region by railways. Drs. Wu Lien-Teh and Pulitzer carried out experiments at Harbin to determine whether plague could be conveyed by *Pulex irritans*, L. Two infected fleas, after 24 hours' starvation, transmitted the disease from man to guineapigs, which died on the ninth day.

Rao (S. Sundar). **The History of Tick-bites in Cases of Tick-typhus in India.**—*Ind. Med. Gaz.*, lxiv, no. 2, pp. 76–77, 1 fig., 1 ref. Calcutta, February 1929.

Cases of tick-typhus are sporadic in India and usually occur in hilly tracts adjoining forests. Persons suffering from the disease have frequently denied that they had been bitten by ticks, but the author describes instances of two persons, one of them an entomologist, each of whom for a long period was unaware of the presence on his person of a tick that had partly embedded itself in the skin ; indurations resulted from the bites. One of these ticks was identified as the nymph of *Rhipicephalus haemaphysaloides*, Sup. *Haemaphysalis bispinosa*, Newm., which in the forest occurs accidentally on man in far greater numbers than the former species, does not attack him.

[Pavlovskiĭ (E. N.).] **Павловский (Е. Н.). Cattle Dips against Ticks in the Village of Semenovshchino in the Novgorod Government.** [*In Russian.*]—*Rev. Microbiol. Epidémiol. Parasitol.*, vii, no. 4, pp. 368–376, 8 figs., 3 refs. Saratov, 1928. (With a Summary in English, p. 458.)

This is a detailed description of the first dipping tank used in Russia for the control of *Ixodes ricinus*, L., on cattle with solutions of sodium arsenite. This tick is the sole vector of piroplasmosis in north-western Russia, and the necessity of constructing more of such tanks is emphasised. Diagrams and estimates of the cost of construction are given.

[Olenev (N. O.) & Pomerantzev (B. I.).] **Оленев (Н. О.) и Померанцев (Б. И.). Spraying Cattle with Arsenicals and its Effect on Ticks.** [*In Russian.*]—*Rev. Microbiol. Epidémiol. Parasitol.*, vii, no. 4, pp. 376–385, 3 figs., 2 refs. Saratov, 1928. (With a Summary in English, pp. 458–459.)

Experiments in spraying cattle were carried out in the summer of 1927 in the Novgorod Government to determine the minimum concentration of arsenical solutions that would kill *Ixodes ricinus*, L. Sodium

arsenite dissolved in cold water was used. The method of spraying is described in detail. The poison proved very effective for the control of the ticks, the percentage of dead individuals being directly correlated with the concentration of the solution. A solution containing 0·12 per cent. arsenic killed 25–30 per cent. of the ticks within 12 to 36 hours; one containing 0·16 per cent. killed 40 per cent. in the same period; and one containing 0·20 per cent. killed 64 per cent. within 39 hours without causing any injury to the cattle. The effect of the sprays on the ticks was much greater when the latter were allowed to remain on the cattle than when they were removed after spraying, evidently owing to the high temperature of the hosts and to the lack of humidity. The author considers, however, that dips are much more effective than sprays and discusses their advantages.

Between the middle of May and the middle of September ticks of all stages infested the cattle at pasture. The infestation decreased after midsummer, probably because most of the ticks had engorged, but as soon as the cattle were moved in August to a fresh pasture it again increased considerably.

[Bozhenko (V. P.) & Tzeĭss (A. L.).] **Боженко (В. П.) и Цейсс (А. Л.). Trypanosomes of Sheep.** [*In Russian.*]—*Rev. Microbiol. Epidémiol. Parasitol.*, vii, no. 4, pp. 417–420, 1 fig., 13 refs. Saratov, 1928. (With a Summary in German, pp. 461–462.)

A short account is given of observations on the trypanosomes of sheep, which were made in August and September 1927 in the southern part of the Ural Government. No trypanosomes were found in goats, but 9·46 per cent. of the sheep were infected. The Hippoboscid, *Melophagus ovinus*, L., is probably the vector of the trypanosomes, as all individuals collected on sheep contained large numbers of flagellates, a description of which is given. The authors think that these are *Trypanosoma melophagium*, but further evidence on this point is required.

[Shakhov (S. D.).] **Шахов (С. Д.). Flagellates in the Gut of Mosquitos.** [*In Russian.*]—*Rev. Microbiol. Epidémiol. Parasitol.*, vii, no. 4, pp. 421–422, 1 fig. Saratov, 1928. (With a Summary in English, p. 462.)

A detailed description is given of flagellates found in *Anopheles maculipennis*, Mg., near Kharkov. Other parasites observed included *Agamomermis* in *Aëdes* and Nematodes in the adults and the larvae of *A. maculipennis*.

[Makarov (A. K.).] **Макаров (А. К.). Contribution to the Fauna of Ectoparasites of Southern Ukraine. Fleas.** [*In Russian.*]—*Rev. Microbiol. Epidémiol. Parasitol.*, vii, pt. 4, pp. 431–434, 16 refs. Saratov, 1928. (With a Summary in German, pp. 463–464.)

This is a short account of investigations made in the summer of 1927 near Odessa by the Plague Department of the Odessa State Bacteriological Institute on various rodents. The following fleas were found on *Citellus*: *Ceratophyllus simplex*, Wagn., *Ctenophthalmus orientalis*, Wagn., which also occurred on the field mouse, *Mus sylvaticus*, *Neopsylla setosa*, Wagn., and *Frontopsylla semura*, Wagn. & Ioff;

the last two species have never before been recorded from the Odessa region. In July the fleas collected from man were mostly *Pulex irritans*, L., with a few *Ctenocephalus felis*, Bch., and *C. canis*, Curt.

[Pikul' (I. N.).] **Пикуль (И. Н.). Fièvre récurrente à tiques d'Asie centrale et son agent pathogène.** [*In Russian.*]—*Russ. J. Trop. Med.*, vi, no. 10, pp. 612–618, 2 charts, 10 refs. Moscow, 1928. (With a Summary in French.)

This is an account of the work of an expedition to the town of Ferghan in Central Asia, organised in the summer of 1927 to determine the occurrence of relapsing fever in that district. Cases observed in the course of one month are discussed. The town is an endemic centre of the disease, the vector being a tick of the genus *Ornithodorus*, the species of which has so far not been definitely determined [*cf. R.A.E.*, B, xvi, 110]. The ticks occurred in European as well as in native dwellings, but in the former they were difficult to discover, as they hid in the deal boarding of the walls and floor, whereas in native clay huts they could easily be found in cracks in the walls, the larvae and first instar nymphs always occurring near the floor in damp places, those of the following instars higher, and the adults in the ceiling.

Infection was produced in man, mice and guineapigs by the bites of ticks that had been fed on patients. The application to the scarified skin of man of a single drop of blood taken from a guineapig infected by a tick produced a typical infection. The causal agent is a spirochaete that does not differ morphologically from *Spirochaeta duttoni* and *S. recurrentis* (*obermeieri*), but cross-immunity experiments indicate that it is distinct from them, and it is named *S. usbekistanica*, sp. n.; its relation, if any, to *S. persica*, about which very little is known, remains undetermined.

[Nikol'skiĭ (V.).] **Никольский (В.). Contribution to the Question of Entomological Observations by Malaria Stations.** [*In Russian.*] —*Russ. J. Trop. Med.*, vi, no. 10, pp. 668–672. Moscow, 1928.

This is an attempt to improve the questionnaires used by malaria stations in Russia for observations on mosquitos, which are sometimes compiled with a lack of knowledge of the biology of individual species and are not uniform in programme. The author suggests a new programme for observations on various mosquitos in northern latitudes throughout the year, which he thinks should be adopted by all malaria stations in order to co-ordinate their work and thus facilitate the study of malaria.

[Mchedlidze (V.).] **Мчедлидзе (В.). Antimalarische Tätigkeit in Batum im Sommer 1928.** [*In Georgian.*]—*Nachr. trop. Med.*, i, no. 2, pp. 151–154. Tiflis, December 1928. (With Summaries in Russian and German, pp. 217 & 222.)

The following is taken from the summaries: A survey of the town of Batum in the summer of 1928 revealed the occurrence of large numbers of *Anopheles maculipennis*, Mg., and *A. bifurcatus*, L., in the outskirts of the town, and of *Aëdes argenteus*, Poir. (*Stegomyia fasciata*, F.) in the town itself, the latter being especially dangerous in view of the recent epidemic of dengue in Greece. Immediate control measures

were therefore taken, including the regular oiling of canals, marshes, etc., in and around the town, and covering tubs and other reservoirs for keeping water, and resulted in a considerable decrease in the number of mosquitos and in the number of patients suffering from malaria for the first time.

[Kandelaki (S.).] **Канделаки (С.). Dengue Fever.** [*In Georgian.*] —*Nachr. trop. Med.*, ii, no. 2, pp. 73–79, 2 figs., 10 refs. Tiflis, February 1929. (With Summaries in Russian and German, pp. 171 & 177.)

In view of the serious epidemic of dengue in Greece in 1928, the author points out the possibility of its introduction into Georgia and briefly discusses its history, etiology and diagnosis. *Aëdes argenteus*, Poir. (*Stegomyia fasciata*, F.) often occurs along the Black Sea coast, but is especially abundant in Sukhum and Batum, its chief breeding-places being tubs containing rainwater, which are kept in nearly every yard.

In 1917 the author studied a disease in Trebizond, which was supposed to be dengue but which he discovered to be sandfly fever. Great numbers of *Phlebotomus papatasii*, Scop., occurred in the infested region, and infection of man by this sandfly was obtained experimentally.

[Rukhadze (N.).] **Рухадзе (Н.). Ueber die Rolle der Haustiere in der Malaria-prophylaxe.** [*In Georgian.*]—*Nachr. trop. Med.*, ii, no. 2, pp. 84–88. Tiflis, February 1929. (With Summaries in Russian and German, pp. 172–173 & 178–179.)

A malaria survey was carried out in a poor quarter of Sukhum, where domestic animals are kept in sheds and stables. Numerous Anophelines were collected, the majority of which occurred in pigsties and cowsheds, whereas in human dwellings and stables they were far less abundant. Of the mosquitos dissected, 70 per cent. contained the blood of pigs, 16·8 per cent. that of cattle, and only 10·8 per cent. human blood. In another district, where the animals are not stabled, the majority of mosquitos occurred in houses and contained human blood. The percentage of the population infected with malaria was considerably higher in a mountainous district than in a marshy place near the sea, this being evidently connected with the fact that no domestic animals are kept in mountainous villages. The author concludes that stabled animals attract Anophelines and that this is directly proportional to the time they are kept in stables.

Kalandadze (L.). **Каландадзе (Л.). Wie das Studium der Mücken in den Georgischen Verhältnissen vor sich gehen muss.** [Proposals for the Study of Mosquitos under the Conditions of Georgia.] [*In Georgian.*] —*Nachr. trop. Med.*, ii, no. 2, pp. 89–98, 10 refs. Tiflis, February 1929. (With Summaries in Russian and German, pp. 173 & 179.)

This is a detailed discussion of the various problems connected with the bionomics of Anophelines and their relation to malaria that require study in Georgia.

LANGERON (M.). **Mycose d'une larve de** *Culex hortensis* **de Corse.**—*Ann. Paras. hum. comp.*, vii, no. 2, pp. 107–111, 3 figs., 6 refs. Paris, 1st March 1929.

The occurrence of a fungous infection, of a type not previously recorded from mosquito larvae, in a larva of *Culex hortensis*, Fic., from Corsica, is described.

ROUBAUD (E.). **Cycle autogène d'attente et générations hivernales suractives inapparentes chez le moustique commun,** *Culex pipiens* **L.**—*C.R. Acad. Sci. Fr.*, clxxxviii, no. 10, pp. 735–738, 1 ref. Paris, 1929.

In hibernating females of *Culex pipiens*, L., the resting stage is not the result of cold, but of a normal specific asthenia, to recover from which, rest at a low temperature is essential. Prematurely subjected to heat, they die without ovipositing. In addition to this strain of *C. pipiens*, there is one in which the reproductive activity of both sexes is maintained throughout the year. In a cellar in Paris kept during the winter at over 20° C. [68° F.], continuous development of the mosquito was observed from November to February, although no engorged female was seen. This strain, when it begins to feed, shows a marked preference for fowls rather than for mammals, but after a first feed on a fowl it will attack man.

VAN THIEL (P. H.). **Die holländischen Malariamücken.** [The Dutch Malaria Mosquitos.]—*Abh. Gebiete Auslandsk. Hamburg. Univ.*, xxvi, Ser. D. (Med.), ii (Festschr. Nocht), pp. 547–552, 11 refs. Hamburg, 1927.

The Anophelines found in Holland are *Anopheles bifurcatus*, L., which is rare; *A. plumbeus*, Steph. (*nigripes*, Staeg.), which is even rarer; and *A. maculipennis*, Mg., with its variety, *atroparvus*, van Thiel [*cf. R.A.E.*, B, xv, 180, etc.].

BENARROCH (E.). **Estudios relativos al paludismo.**—Tesis presentada a la Universidad Central de Venezuela, 38 pp., 4 figs., 17 refs. Caracas, 1928.

This paper describes investigations undertaken to determine the identity of the mosquitos that transmit malaria in Venezuela, though further study is required to obtain definite results. The following species, represented by only a few individuals in most cases, were subjected to artificial infection: *Anopheles pseudopunctipennis*, Theo., *A. apicimacula*, D. & K., *A. punctimacula*, D. & K., *A. albimanus*, Wied., *A. tarsimaculatus*, Goeldi, *A. strodei*, Root, *A. bachmanni*, Petrocchi, *A. argyritarsis*, R.-D., and *A. albitarsis*, Arrib. Oöcysts were found in 1 of 29 specimens of *A. albimanus*. Of 721 mosquitos captured at Maracay in 1927, none harboured cysts or sporozoites. Besides the species mentioned above, *A. eiseni*, Coq., *A. punctipennis*, Say, *A. mediopunctatus*, Theo., *A. vestitipennis*, D. & K., *A. bellator*, D. & K., and *A. cruzi*, D. & K., occur in Venezuela, forming, together with *A. darlingi*, Root, a total of 16 species, but these six species are either rare or of such limited distribution that they probably play no part

in transmitting malaria. As *A. apicimacula* belongs to the *Pataglamya* group and *A. punctimacula* to the *Arribalzagia* group, these species can be disregarded, at least at present. There thus remain only the species of the dangerous *Nyssorhynchus* group and *A. pseudopunctipennis*. Of these, *A. albimanus* is undoubtedly an important vector, at any rate in the region of Lake Valencia ; it is also a markedly domestic species. *A. pseudopunctipennis* is the most domestic species at Maracay, and though it has not been found infected, it is suspected of being an important vector. *A. darlingi* and *A. albitarsis* are almost exclusively found in the plains, where they are probably the chief vectors. *A. argyritarsis* has been incriminated by Stephens in the region of Lake Maracaibo. *A. tarsimaculatus*, *A. strodei* and *A. bachmanni* are very similar species, the distinction between which may perhaps be justified by differences in their relation to malaria. They are widely distributed throughout Venezuela and are the most common species in the region of Lake Valencia during the malarial season. *A. bachmanni* is the most domestic of these.

Lutz (A.). **Estudios de zoologia y parasitologia venezolanas.**—Super Roy. 8vo, 133 pp., 26 pls., refs. Rio de Janeiro, December 1928.

The first part of these records of observations made in Venezuela in 1925 deals with entomology, more especially with blood-sucking Diptera, and was prepared in collaboration with Dr. Nuñez Továr. It includes descriptions of new species of mosquitos, Simuliids and Tabanids and of the larvae of some of the mosquitos.

African Conference of the Yellow Fever (Dakar—April 1928).—Roy. 8vo, 301 pp., 3 portr. **Conférence africaine de la fièvre jaune (Dakar—Avril 1928).**—Roy. 8vo, 296 pp., 3 portr. Paris, L. Fournier, 1928 (French edn.) & 1929 (English edn.). Price *Fr.* 35.

This conference was called on the initiative of the Governor-General of French West Africa, with the object of co-ordinating measures against yellow fever in the various countries of that region. These volumes, published in French and English by the General Government of French West Africa, contain the proceedings and resolutions of the conference. The papers read include reports on yellow fever in Senegal, Accra and Togo in 1927 and in Lagos in 1925 and 1926 ; accounts of the experimental transmission of yellow fever to *Macacus rhesus* (*R.I.E.*, B, xvi, 113, 180) ; and an account, by F. P. J. Sorel, of the measures carried out against *Aëdes argenteus*, Poir. (*aegypti*, L.) and yellow fever in Dakar in 1927, including the successful use of cylinders of liquid sulphur dioxide in fumigating buildings for the destruction of the adult mosquitos.

Hindle (E.). **An experimental Study of Yellow Fever.**—*Trans. R. Soc. Trop. Med. & Hyg.*, xxii, no. 5, pp. 405–430, 1 fig., 18 refs. London, 9th March 1929.

In this paper the author discusses the history of yellow fever and gives the results of his recent researches in London. It has been proved that yellow fever can be transmitted to monkeys by the bites of infected

mosquitos [*R.A.E.*, B, xvi, 180] and that the mosquito, once infected, remains so for the duration of its life, so that the maintenance of infected mosquitos constitutes a simple method of preserving the virus. The infected mosquitos were kept in containers made from pieces of glass tubing about 2¼ inches in diameter and 4 inches long. The bottom of the tube was covered with ordinary mosquito netting and the top with bolting silk, held in place by bands of adhesive plaster. A short piece of glass tubing about ⅜ in. in diameter was fixed in the middle of the silk to serve as an entrance. About ten mosquitos were introduced into each container by means of a special glass " fly pipette " [*R.A.E.*, B, xv, 177], and the entrance was then plugged with absorbent cotton wool pushed down until it projected into the container. The plug was kept wet, and the mosquitos not only sucked up the water from the wet cotton wool, but also laid their eggs on it. They readily fed on monkeys [*Macacus rhesus*] through the netting and generally engorged within 5–10 minutes. When not fed on blood, the mosquitos were supplied with sugar every other day by placing a piece of cotton wool soaked in sugar solution on the top of the container. If the isolation of single mosquitos was required, the whole container was lightly etherised and the insects removed by means of a camel-hair brush passed down the entrance tube. They soon recovered and showed no ill effects from this treatment. The mosquitos were kept inside an incubator at 28° C. [82·4° F.], and when they were fed on a monkey the chamber was heated to approximately the same temperature.

Two strains of *Aëdes argenteus*, Poir. (*aegypti*, L.) were used in the transmission experiments, one from West Africa and the other from India. The African mosquitos were readily infected by feeding on infected monkeys and became infective after an interval of only nine days. In view of the constantly fatal results obtained by direct inoculation of fresh virus from the liver, it is noteworthy that two out of six monkeys infected by the bites of these mosquitos recovered. In one case in which the mosquito merely inserted its proboscis for two or three seconds without ingesting blood, a fatal infection was produced. With a view to determining the distribution of the virus in the mosquito, infected individuals were dissected and various parts of the body ground up in saline and inoculated into monkeys. A salivary gland was inoculated into one monkey and the gut contents from the same mosquito, excluding the proboscis and oesophagus, into another. Both monkeys died of yellow fever, showing that the virus persists in other parts of the mosquito in addition to the salivary glands. The contents of mosquitos fed on an infected monkey were inoculated into normal monkeys after intervals of 3 and 8 days respectively, when their bites were still non-infective. Both monkeys died, showing that the virus persists during the extrinsic incubation period. A monkey inoculated with the legs containing coelomic fluid of two infected mosquitos remained uninfected, whereas another monkey inoculated with the remainder of their bodies died. These results indicate that the virus may be present in the organs of infected mosquitos without necessarily invading the coelomic fluid. The question as to whether infection can be transmitted to the offspring of an infected mosquito remains unsettled, but as the virus is not confined to the salivary glands, the possibility that the infection is inherited is not entirely eliminated.

Four adults of the Indian strain fed on an infected monkey failed to produce infection in normal monkeys, but a monkey subsequently inoculated with their contents died of yellow fever, thus showing that

this strain may harbour the infection in its body without necessarily becoming infective by its bite. Six mosquitos of this same race fed three times on infected monkeys at intervals of 7 and 6 days respectively were fed 5 days after the last meal on a normal monkey and re-fed 3 days later on the same animal. This animal showed a rise of temperature 8 days after it was first bitten and died of yellow fever 4 days later. This shows that the Indian strain of *A. argenteus* is capable of transmitting yellow fever, and there is consequently no foundation for the suggestion made by Legendre that the absence of this disease from the Orient may be due to the fact that the local mosquito is resistant to infection [*R.A.E.*, B, xvi, 3]. It seems possible, however, that the Indian strain is not so efficient a carrier as the West African, since two out of three of the former produced infection, whereas four of the latter, kept under identical conditions and fed on infected animals in the same way, all failed to become infective so far as their bites were concerned. On the other hand, the results indicate clearly that if yellow fever reaches India, the indigenous mosquitos could serve as efficient vectors and the stringent quarantine regulations concerning this disease are consequently fully justified.

HIRST (A. S.). **On the " Scrub Itch Mite " of North Queensland** (*Trombicula hirsti* **Sambon**)—**a possible Carrier of Tropical Pseudotyphus.** —*Trans. R. Soc. Trop. Med. & Hyg.*, xxii, no. 5, pp. 451–452, 5 figs., 2 refs. London, 9th March 1929.

A redescription is given of the larval mite, *Trombicula hirsti*, Sambon [*R.A.E.*, B, xvi, 19], which is possibly a vector of a typhus-like fever in North Queensland. A mite of similar habits, which causes severe dermatitis, occurs in South Australia.

BRUG (S. L.). **Aanteekeningen omtrent muskieten (iv).** [Notes on Mosquitos. iv.]—*Geneesk. Tijdschr. Ned.-Ind.*, lxviii, no. 7, pp. 921–927, 3 pls., 7 refs. Weltevreden, 1928. (With a Summary in English.)

Anopheles (*Bironella*) *travestitus*, sp. n., is described from Ceram, Moluccas, and compared with *A.* (*B.*) *bironelli*, Christophers. The differences between *Anopheles* and *Culex* are discussed, and it is concluded that the abdominal scaling is the only reliable differential character. The characters distinguishing the larvae of *A. separatus*, Leic., and *A. umbrosus*, Theo., are indicated.

MERTENS (W. K.). **Mijn ervaring omtrent Stoxal als larvicide middel.** [My Experience of Stoxal as a Larvicide.]—*Geneesk. Tijdschr. Ned.-Ind.*, lxviii, no. 7, pp. 1010–1014, 3 refs. Weltevreden, 1928.

The salt-pans at Macassar, covering over 300 acres, produce large numbers of *Anopheles* (*Myzomyia*) *subpictus*, Grassi (*rossi*, Giles). The author carried out experiments with stoxal [*R.A.E.*, B, xvi, 63, etc.], but found this larvicide quite ineffective at the prescribed rate of 1 gm. (undiluted) to 100 sq. m. Even with 10 gm. only 32–50 per cent. of the larvae were killed. The dust requires to be mixed with a carrier, as the quantities are otherwise too small to permit of even distribution. Even with 10 gm. to 100 sq. m. no harm was done to fish.

PAPERS NOTICED BY TITLE ONLY.

FERRIS (G. F.). **The Principles of Systematic Entomology.**—*Stanford Univ. Pub. Biol. Sci.*, 169 pp., 11 figs. Stanford Univ., Cal., 1928. Price, paper, $2.00; cloth, $2.75. London, Humphrey Milford [1929]. Price, cloth, 12*s.* 6*d.*

SCHULZE (P.) & SCHLOTTKE (E.). **Bestimmungstabellen für das Zeckengenus *Hyalomma* Koch s. str.** [Keys to the Tick Genus *Hyalomma* Koch s. str. (Several new Species and Subspecies).]—*SitzBer. Abh. naturf. Ges. Rostock*, (3) ii (1927–28), reprint 15 pp. Rostock, 1929.

[ROSENHOL'TZ (G. P.) & OVSYANNIKOVA (O. V.).] ROSENHOLZ (H. P.) & OWSJANNIKOWA (O. W.). **Ueber die Rolle der Wanzen (*Cimex lectularius*) und Zecken (*Ornithodorus moubata*) bei der Uebertragung des Milzbrandes.** [On the Rôle of Bugs (*C. lectularius*) and Ticks (*O. moubata*) in the Transmission of Anthrax.]—*Centralbl. Bakt.* (1) Orig., cx, no. 4–5, pp. 160–164. Jena, 11th January 1929. [See *R.A.E.*, B, xvi, 265.]

[MAGNITZKIĬ (V. I.) & GUTZEVICH (A. V.).] MAGNITSKY (W. J.) & GUTZEWITSCH (A. W.). **Zur Frage über die Veränderlichkeit einiger systematischer Merkmale der Arten der Gattung *Phlebotomus*.** [On the Question of the Variation of some Characters of the Species of the Genus *Phlebotomus*.]—*Centralbl. Bakt.* (1) Orig., cx, no. 4–5, pp. 199–208. Jena, 11th January 1929. [See *R.A.E.*, B, xvi, 192.]

[MOSKVIN (A. I.).] MOSKWIN (J. A.). **Die Wirkung des Bisses der Zecke *Ornithodorus papillipes* Bir. auf die Haut der Versuchstiere** [The Action of the Bite of the Tick, *O. papillipes*, on the Skin of Laboratory Animals.]—*Centralbl. Bakt.* (1) Orig., cx, no. 4–5, pp. 208–213, 2 figs., 5 refs. Jena, 11th January 1929. [See *R.A.E.*, B, xvi, 184.]

SINTON (J. A.). **Notes on some Indian Species of the Genus *Phlebotomus*. Part xxiv. *Phlebotomus barraudi* n. sp.** [Male and Female described from Assam.]—*Ind. J. Med. Res.*, xvi, no. 3, pp. 716–724, 2 pls., 3 refs. Calcutta, January 1929.

[GORDADZE (G.) & KAMALOV (N.).] **Гордадзе (Г.) и Камалов (Н.). *Taeniorhynchus* (*Mansonia*) *richiardii*, Fic., in Georgia.** [*In Georgian.*]—*Nachr. trop. Med.*, i, no. 1, pp. 58–59. Tiflis, November 1928. (With Summaries in Russian and German, pp. 107 & 112.)

PULIKOVSKY (N.). **Die Respiratorischen Anpassungserscheinungen bei den Puppen der Simuliden. II. Australasiatische Simuliden.** [Respiratory Adaptation in the Pupae of Simuliids. II. Australasian Simuliids.]—*Z. Morph. Oekol. Tiere*, xiii, no. 3–4, pp. 655–664, 17 figs., 4 refs. Berlin, 25th February 1929.

ABBOTT (C. E.). **The Tarsal Chemical Sense of the Screw Worm Fly, *Cochliomyia macellaria*, Fab.**—*Psyche*, xxxv, no. 4, pp. 201–204, 5 refs. Boston, Mass., December 1928.

PAU (A.). ***Cuterebra semilutea*, sp. n. (Ins. Dipt.), sowie Schlüssel zur Bestimmung der *Cuterebra*-Arten.** [*C. semilutea*, sp. n., and Key to the Species of *Cuterebra*.]—*Senckenbergiana*, xi, no. 1–2, pp. 1–7, 2 figs. Frankfurt a. M., 16th February 1929.

BAU (A.). **Ueber *Aulacocephala* und *Rogenhofera*. (Diptera, olim Oestridae).** [On *Aulacocephala* and *Rogenhofera*. *A. badia*, Gerstäcker, ♂ described; *R. dasypoda*, Brauer, and *R. grandis*, Guér., further described.]—*Konowia*, vii, no. 4, pp. 298–302, 23 refs. Vienna, 31st December 1928.

Schwetz (J.), Collart (A.) & Geernick (—). **The Sporozoic and the Zygotic Index of the *Anopheles* of Stanleyville (Congo-belge).**—*Trans. R. Soc. Trop. Med. & Hyg.*, xxii, no. 5, pp. 457-463. London, 9th March 1929.

Mosquitos are not numerous at Stanleyville, as compared with similar places in Central Africa. Few are found in the houses of Europeans, and of those that do enter, only a very small proportion belongs to the genus *Anopheles*. In the native dwellings there are many more mosquitos, and nearly all are Anophelines. Europeans suffer relatively little from malaria, but the malaria index among the natives is very high. The parasite is *Plasmodium falciparum* in 80-90 per cent. of the cases, and *P. malariae* in the remainder.

The most important and widely distributed species of *Anopheles* is *A. gambiae*, Giles, which breeds in large numbers in pools in and around the town. *A. funestus*, Giles, *A. nili*, Theo., and *A. marshalli* var. *moucheti*, Evans, are rare in the town and its immediate environs, but are fairly common in the surrounding villages; the breeding-places of these three mosquitos are almost identical, the larvae being found singly amongst the vegetation along the banks of rivers and streams. *A. obscurus*, Grünb., and *A. mauritianus* var. *paludis*, Theo., have been taken at Stanleyville, but they are very rare and may be ignored in connection with malaria.

From April to September 1928, Anophelines captured in and around Stanleyville were examined for the presence of sporozoites and zygotes of malaria in the salivary glands and stomach. The results of this investigation, involving the examination of 992 specimens of *A. gambiae*, 132 of *A. nili*, 154 of *A. marshalli* var. *moucheti* and 191 of *A. funestus*, are tabulated. The percentages of infection of salivary glands and stomach, respectively, were 11·5 and 8·4 for *A. gambiae*, 5·3 and 10 for *A. nili*, 4·5 and 4·5 for *A. marshalli* var. *moucheti*, and 4·2 and 3·1 for *A. funestus*. Both salivary glands and stomach were infected in 22 specimens. With few exceptions, sporozoites were extremely numerous in the salivary glands, whereas oöcysts were somewhat rare in the stomachs.

Various parasitic organisms other than *Plasmodium* were found in some of the mosquitos; these are briefly discussed.

Iyengar (M. O. T.). **Comparative Study of the Larvae of *Anopheles fuliginosus*, *pallidus* and *philippinensis*.**—*Ind. J. Med. Res.*, xvi, no. 3, pp. 639-645, 4 pls., 3 refs. Calcutta, January 1929.

Anopheles pallidus, Theo., and *A. philippinensis*, Ludl., are widely distributed in Bengal, and the scarcity of published records of their presence is evidently due to their identification as *A. fuliginosus*, Giles. The characters distinguishing the adults were not widely understood, and the larvae have been insufficiently known (or probably not known at all) to enable the species to be recognised in the larval stage. Detailed descriptions of the mature larvae of these three species are therefore given, together with a comparative table showing the characters by which they may be distinguished. As it appears likely that the three species vary appreciably in their relation to malaria, their accurate identification is of economic importance.

KORKE (V. T.). **Observations on Filariasis in some Areas in British India. Part III.**—*Ind. J. Med. Res.*, xvi, no. 3, pp. 695–715, 1 sketch map, 6 refs. Calcutta, January 1929.

Further investigations on filariasis in the province of Bihar and Orissa [*cf. R.A.E.*, B, xvi, 248] were carried out in areas of various types from April to July 1928. *Culex fatigans*, Wied., appears to be present in almost all the areas investigated, and in addition *C. vishnui*, Theo., *Taeniorhynchus annuliferus*, Theo., and *T. uniformis*, Theo., are abundant in the area showing the highest rate of filarial infection. Deviations from the typical form of *Filaria bancrofti* were found in man in this area. It is highly probable that in addition to *C. fatigans* the other mosquitos mentioned also carry infection, and that the adaptation of the parasite to these species has resulted in the deviations observed. In this area 8·3 per cent. of the mosquitos (mostly *Culex*, though the species are uncertain) showed developmental stages of *F. bancrofti*.

MCCOMBIE YOUNG (T. C.) & ABDUL MAJID. **Further Observations on Malaria in Coorg.**—*Ind. J. Med. Res.*, xvi, no. 3, pp. 766–769, 1 ref. Calcutta, January 1929.

A further survey of the Anopheline breeding-places in Mercara [*cf. R.A.E.*, B, xvi, 167] was begun in March 1928. During March the predominant species was *Anopheles jeyporiensis*, James, but *A. maculipalpis*, Giles, and *A. karwari* var. *majidi*, Young & Majid, were common and *A. subpictus*, Grassi, *A. vagus*, Dön., *A. barbirostris*, Wulp, and *A. jamesi*, Theo., were also collected. The drains, which in May 1927 contained large numbers of *Anopheles listoni*, List., in March 1928 contained only *A. jeyporiensis*. By the third week in April, *A. listoni* and *A. maculatus*, Theo., began to appear in these drains, and the latter, of which only one individual was collected in May 1927, was later very plentiful. By the end of April *A. jeyporiensis* had almost entirely disappeared, being replaced by the above two species and *A. culicifacies*, Giles. It is significant that the appearance of these three important malaria carriers preceded and coincided with the season of greatest malaria incidence in April and May. *A. maculipalpis* and *A. karwari* var. *majidi* occurred in the " jungle " waters. *A. leucosphyrus*, Dön., is also recorded from Coorg. All the areas in which the three carriers had been collected were sprayed with crude oil, and no larvae were found when the breeding grounds were examined two days later. It is proposed to continue these measures until the onset of the monsoon rains and also to some extent in the autumn.

A survey of two adjoining coffee estates, the splenic indices of which differed considerably, indicated that the high rate in one was due to the proximity to the coolie lines of a stream in which *A. listoni*, *A. maculatus* and *A. culicifacies* were breeding. It would appear that in selecting the site for the lines of coffee estates, a valley with a stream running through it should be avoided, and the top of a hill with open ground round it, free from jungle, should be preferred, despite the inconvenience of the distance of such a site from the pulp house, which on account of the need for water is usually situated in a valley.

A stream running through the lines on another estate had been periodically sprayed against mosquitos, and no Anophelines could be found in it. A similar but untreated stream supplying the pulp house was also free from larvae, and investigation showed it to be full of the

decaying fruit of a wild fig. A single experiment seemed to indicate that a decoction of this fermenting fruit added to water containing Anopheline larvae was lethal to them in two days, but was less effective against Culicine larvae. It would therefore appear possible that this wild fig, which is used as a shade-tree for coffee, may have some value in discouraging Anopheline breeding.

CARTER (H. F.) & JACOCKS (W. P.). **Observations on the Transmission of Malaria by Anopheline Mosquitoes in Ceylon.**—*Ceylon J. Sci.*, Sect. D, Med. Sci., ii. pt. 2, pp. 67–86, 5 pls., 4 figs., 2 maps. Colombo, 13th February 1929.

The following is largely taken from the authors' summary. Investigations into the natural infection of indigenous Anophelines with malaria parasites were carried out in villages and on estates in five separate localities situated in highly endemic areas in Ceylon, and were made during the north-east monsoon periods of 1925–28 in four of these localities, and in July 1928 in the fifth. *Anopheles culicifacies*, Giles, was the species examined in greatest numbers (1,639 individuals), since it was much more prevalent than any other in dwellings in the different localities. Other species dissected were *A. subpictus*, Grassi (288), *A. hyrcanus*, Pall. (33), *A. listoni*, List. (25), *A. fuliginosus*, Giles (17), *A. jamesi*, Theo. (16), *A. barbirostris*, Wulp (13), *A. tessellatus*, Theo. (1), and *A. maculatus*, Theo. (1). Eighty-one individuals of *A. culicifacies* only were infected. They were obtained from estate lines where epidemic conditions were prevalent or had recently been so. No infected mosquitos occurred among those collected from village dwellings, although in at least two out of the three villages visited malaria was prevalent at the time. Oöcyst infections were more often found during the early part of the rainy season (November), sporozoite infections being definitely more frequent in January.

The conclusion of Senior-White that *A. maculatus* is the only malaria carrier of importance in the district of Matale [*R.A.E.*, B, ix, 147] was presumably based upon epidemiological data, no dissections having apparently been undertaken.

HOFFMAN (W. A.), MARÍN (R. A.) & BURKE (A. M. B.). **Filariasis in Porto Rico. I. Progress Report on general Survey.**—*Porto Rico Rev. Publ. Hlth. Trop. Med.*, iv, no. 3, pp. 120–127, 1 map. San Juan, P.R., September 1928.

This paper gives the preliminary results of surveys carried out in 31 localities in Porto Rico; in each locality, blood examinations were made of a number of persons for the presence of *Filaria* (*Wucheria*) *bancrofti*, and search was made for evidence of mosquito breeding, with special reference to the common house mosquito, *Culex fatigans*, Wied. The total number of persons examined was 3,743, of whom 197 were found to be infected. The percentage of infected persons in the various localities varied from 0 to 13·04; the disease was more frequent in the moist coastal areas. The movements of the population of the island are so extensive that the spread of infections such as filariasis is easy, and the localisation of endemic foci difficult. *C. fatigans* was found in all the localities visited, though it was scarce at higher altitudes; in several cases it was breeding extensively in household storage water.

BARBER (M. A.) & KING (C. H.). **Some Notes on the Limitations of Screens in the Prevention of Malaria.**—*Publ. Hlth. Rep.*, xliv, no. 10, pp. 523–528, 2 figs. Washington, D.C., 8th March 1929.

An examination of the numbers of Anophelines found in unscreened and screened houses in north Mexico showed that screens, when not defective, are a good protection against mosquitos, houses without screens containing sometimes as many as eighteen times the number found in well-screened dwellings. Malaria in one locality, however, had actually increased in spite of a high degree of screening, while in another it persisted, though in diminishing rate, long after the village was well screened. The probability was that in both these cases the inhabitants did not remain behind their screens at nightfall. It is suggested that it is generally well worth while to screen verandahs as well as doors.

BOYD (M. F.). **Studies on the Bionomics of North American Anophelines: Physical and Chemical Factors in their Relation to the Distribution of Larvae in northeastern North Carolina.**—*Amer. J. Hyg.*, ix, no. 2, pp. 346–370, 1 diag., 6 charts, 3 refs. Baltimore, Md., March 1929.

The following is taken from the author's summary and conclusions. The breeding of *Anopheles quadrimaculatus*, Say, and *A. crucians*, Wied., does not become widespread until the mean temperatures of available places have reached 21°C. (70° F.) or higher, and declines as they fall below this limit. *A. quadrimaculatus* apparently also requires a minimum diurnal range of temperature variations. When it breeds in the shade, the water is found to be warmer than is usual in such situations. *A. punctipennis*, Say, however, appears to have lower temperature requirements, but can adapt itself to a wide range of variations. Temperature probably influences the larval period, and this would account for the very rapid development and relatively greater density of adults of *A. quadrimaculatus* in the summer and of *A. punctipennis* in the autumn. These two species prefer neutral or alkaline waters, whereas *A. crucians* prefers neutral or acid ones. No breeding was observed in waters that were devoid of dissolved oxygen. Water with a fairly high concentration of carbon dioxide, which is likely to afford an abundant supply of plankton for larval nutrition, seems to attract *A. quadrimaculatus*. *A. punctipennis* also occurs in waters having as wide a range in the amount of this gas, but apparently not to the same extent as the former species in the higher concentrations.

BOREL (E.). **Les moustiques de la Cochinchine et du Sud-Annam.**—*Arch. Inst. Pasteur Indochine*, no. 8, pp. 41–76, 12 pls. Saigon, October 1928.

This is the third part of a detailed account of the mosquitos of Cochin China and South Annam [*R.A.E.*, B, xvi, 250], and deals with the subgenera *Finlaya*, *Aëdimorphus* and *Ochlerotatus*, of the genus *Aëdes*. The characters distinguishing the subgenera are described, and keys are given to 12 species occurring in Cochin China, descriptions of the adults and in most cases the larvae being given.

Basu (Bhudeb Chandra). **On the Anopheline Mosquitoes of Hazaribagh (Bihar and Orissa).**—*Ind. Med. Gaz.*, lxiv, no. 3, pp. 141–142, 2 figs. Calcutta, March 1929.

In Hazaribagh, a town where malaria has been increasing of recent years, *Anopheles fuliginosus*, Giles, was found breeding in numbers in a swamp and a lake, *A. subpictus*, Grassi, *A. barbirostris*, Wulp, *A. hyrcanus*, Pall., and *A. listoni*, List., being also present. Some larvae of the last-named and large numbers of *A. culicifacies*, Giles, were observed in small streams on the outskirts of the town, and *A. theobaldi*, Giles, and *A. maculipalpis*, Giles, in small seepages. With the exception of the last two, adults of all these species and of *A. pallidus*, Theo., *A. vagus*, Dön., and *A. jeyporiensis*, James, were collected in dwellings and cowsheds in the town.

Schneider (J.). **Organisation und Erfolg der Malariabekämpfung in Palästina.** [The Organisation and Success of Malaria Control in Palestine.]—*Centralbl. Bakt.*, (1) Orig., cxi, no. 1–3, pp. 99–124, 20 refs. Jena, 16th February 1929.

This is a survey based on the literature of the organisation of work against mosquitos and malaria in Palestine and of the success that has been achieved.

[Pevzner (A. I.).] **Певзнер (А. И.). The Malaria Epidemic on the southern Coast of Crimea and Stages of its Control.** [*In Russian.*]—*Russ. J. Trop. Med.*, vii, no. 1, pp. 18–24, 5 figs. Moscow, 1929.

Factors that favour the occurrence of malaria in the South of Crimea include neglect of the irrigation system in plantations and of ornamental waters in parks and former private gardens, and visits of infected people to the South Coast, which is intended to be a State health-resort. The average percentage of malaria infection is 5·5.

Investigations in 1927 showed that larvae and pupae of *Anopheles maculipennis*, Mg., were numerous in pits for collecting water in tobacco and vegetable plantations and in uncemented reservoirs in neglected parks and gardens, and occurred in much smaller numbers in tubs and pits lined with stone.

Future work should include a detailed study of the biology of the mosquitos and the flora of their breeding-places, and systematic filling up of all infested reservoirs.

[Ananyan (S. A.).] **Ананян (С. А.). Essai de destruction des larves d'Anophèles dans les rizières et l'application de l'irrigation discontinue.** [*In Russian.*]—*Russ. J. Trop. Med.*, vii, no. 1, pp. 47–55. Moscow, 1929. (With a Summary in French.)

This is a detailed account of experiments carried out in rice plantations in southern Armenia from the end of June till the middle of October, 1927, on the value of an interrupted system of irrigation in controlling mosquitos. Continuous irrigation of rice-fields during the five summer months, which is generally practised in Armenia, forms very favourable conditions for the breeding of Anophelines and plays a prominent part in the epidemiology of malaria. Those breeding in the rice-fields are *Anopheles maculipennis*, Mg., *A. hyrcanus* var. *pseudopictus*, Grassi, and *A. superpictus*, Grassi. *Culex* was very

abundant in the first half of July, but considerably decreased in numbers in August, when *A. maculipennis* was predominant. During the period of observation, the Anophelines had five generations experimentally, completing their development in 19 days in June, 17 in August, and 27 in September. It was found that the system of keeping a rice-field dry for 4 consecutive days and then irrigating it for 7–10 days completely eliminated Anopheline larvae. Although the experimental fields had been deprived of water for 45–69 days in all, this did not affect the growth of the rice. Oiling the field every 12 days destroyed only some of the larvae, while other experiments were still less effective. Interrupted irrigation is a satisfactory measure provided that the plantations are on level ground, the drains work regularly, and rain is not excessive, but can only be practised when the whole irrigation system of Armenia is centralised and scientifically controlled.

[Mufel' (P. P.).] **Муфель (П. П.).** *Anopheles bifurcatus* **L. im Zentraleschwarzbodengebiet.** [*A. bifurcatus* in the Central Black Soil Region.] [*In Russian.*]—*Russ. J. Trop. Med.*, vii, no. 1, pp. 56-57. Moscow, 1929. (With a Summary in German.)

Anopheles bifurcatus, L., was recorded for the first time in the Voronezh Government in July 1928. The larvae were abundant in a ditch full of water, but free from green weeds and marshy flora, and also in a narrow and shallow river with a growth of *Alisma* and *Sparganium ramosum*.

Hegner (R. W.). **Experimental Studies of Bird Malaria.**—*Quart. Rev. Biol.*, iv, no. 1, pp. 59–82, 13 figs., 34 refs. Baltimore, Md., March 1929.

Previous work on the experimental transmission of bird malaria by mosquitos is reviewed [*R.A.E.*, B, xvi, 61].

Myers (J. G.). **Further Notes on** *Alysia manducator* **and other Parasites (Hym.) of Muscoid Flies.**—*Bull. Ent. Res.*, xix, pt. 4, pp. 357–360. London, March 1929.

Experiments in 1927 and 1928 in the rearing of the Braconid, *Alysia manducator*, Panz., in England for the purpose of shipment to Australia and New Zealand against sheep maggots are discussed. It was found, contrary to previous records, that in England this parasite seems to be largely confined to *Calliphora erythrocephala*, Mg., and *Lucilia* spp., though in Western Australia *Chrysomyia albiceps*, Wied., and in New Zealand *Pollenia* (*Calliphora*) *stygia*, F., are also accepted as hosts. Carrion baits exposed in the open generally attracted *Lucilia* spp., *Calliphora erythrocephala* and *C. vomitoria*, L., in the order given ; it is therefore probable that each of these species is attracted by certain definite products of decomposition, which appear more or less in similar order. The greatest obstacle to the establishment of *A. manducator* in Australia is undoubtedly the presence of *Mormoniella vitripennis*, Wlk., which destroys all the pupae that it can reach without burrowing. This Chalcid is, however, scattered in its distribution and in some country districts does not occur at all. It is evidently a parasite of pupae only ; attempts to induce oviposition on the larvae of *Lucilia* all failed.

Among other parasites, the Ichneumonid, *Atractodes gravidus*, Grav., appears to be confined to *Hydrotaea dentipes*, F., which was studied as a possible enemy of *Lyperosia exigua*, de Meij., a serious pest of cattle and buffalos in Northern Australia. Another species of *Atractodes*, considered to be intermediate between *A. gravidus* and *A. bicolor*, Grav., was observed on the bait among *Alysia manducator* engaged with larvae of *Lucilia* ; it failed to oviposit on *Lucilia*, which is probably not its normal host. The small Cynipid, *Figites striolatus*, Htg., was bred in large numbers from puparia of *H. dentipes*, oviposition occurring in very young larvae ; only one parasite was obtained from each puparium.

GATER (B. A. R.). **An improved Method of mounting Mosquito Larvae.** —*Bull. Ent. Res.*, xix, pt. 4, pp. 367–368, 5 refs. London, March 1929.

The medium found most successful for mounting mosquito larvae consists of distilled water, 10 per cent. ; gum arabic, picked, 8 ; chloral hydrate, 74 ; glucose syrup, 5 ; acetic acid, glacial, 3. The ingredients should be dissolved in the order named, preferably on a water-bath or in an oven at about 50° C. (122° F.), and the fluid filtered by a Buchner funnel and suction pump. A larva is picked out of its bowl with a large-bore pipette and placed on a slide. The surplus water is withdrawn and the larva manoeuvred into the centre of the slide. The mounting medium is then carefully dropped on to the larva, and after a minute a coverglass is lowered into place. Clearing begins as soon as the larva is dead, and is generally complete within 2 hours in the case of Malayan Anophelines. As soon as the preparations are dry externally, they can be ringed. Where identification only is required and not a permanent mount, a simpler medium consisting of 37 per cent. water, 57 per cent. chloral hydrate and 6 per cent. acetic acid can be employed.

HAMLYN-HARRIS (R.). **Notes on the Breeding-places of** *Aëdes* (*Finlaya*) *notoscriptus*, **Skuse, in Queensland.**—*Bull. Ent. Res.*, xix, pt, 4, pp. 405–409, 6 refs. London, March 1929.

A continuous study of mosquito breeding-places frequently reveals results of a contradictory nature, largely owing to the fact that the conditions under which mosquitos are forced to live are often very diverse at different times. Thus *Aëdes* (*Finlaya*) *notoscriptus*, Skuse, which is a semi-domestic species, may at times become definitely domestic. This mosquito has already taken to breeding in water-tanks in Western Australia, and in Brisbane, where its former breeding-places have been largely done away with, the same thing may occur. It breeds all the year round in Brisbane, so long as water is available, particularly in broken bamboo and also in the leaves of wild pineapple (*Bromelia*). The water chosen for breeding is preferably alkaline. The elimination of preferential breeding-places tends to drive mosquitos to choose other quarters, and in this way the control of gully-traps in the suburbs of Brisbane has driven *Culex fatigans*, Wied., to breed in the cemeteries, where *A. notoscriptus* also occurs in numbers. In a few cases *A. argenteus*, Poir., is also found in association with these two species.

Certain general observations have been noted in the course of the present mosquito surveys. Receptacles with wide mouths, where the water surface is easy of access, are preferred for oviposition, and

vessels offering protection from the sun, or containing shelter in the form of decaying vegetation, are preferred to clear glass bottles, though vessels containing fresh decaying matter are not selected preferentially. Larvae of *A. notoscriptus* thrive best in vegetable matter from which the grosser products of decomposition have been eliminated. In suitable vessels hundreds of larvae of *A. notoscriptus* or of *C. fatiguns* may be found at once, sometimes in such numbers that if it were not for high mortality and cannibalism the vessel could not contain them all. The former has occasionally been found in wells, but it is in such temporary breeding-places as bamboo stems after rain that the viability of the eggs assumes a special significance.

SIMMONS (R. J.). **Notes on a Tsetse Belt in Western Uganda.**—*Bull. Ent. Res.*, xix, pt. 4, pp. 421–433, 2 pls., 1 fig., 1 map. London, March 1929.

The history of part of South Ankole, Uganda, is recorded with special reference to the occurrence of *Glossina morsitans*, Westw. It first appeared from the south in 1906, and cattle that were moved north in consequence spread small numbers of the fly northward. This resulted in an epizootic of trypanosomiasis in 1910–11, and again during 1914–15 military operations caused a further rapid spread, principally along the line of communication to the north. After the fly had advanced practically 25 miles in 4 years, the cessation of military activity in Ankole in 1916 caused a marked diminution of traffic, with consequent regression of the fly. An outbreak of rinderpest in 1919 destroyed an important alternative food supply, thus further reducing the numbers, and eventually after 27 years the fly had retired to the points from which it had originally spread.

At the present time, the Ntundu Valley is the primary centre of tsetse and serves as a reservoir to other fly areas. Game is considered essential for the life of the fly, but transportation by man and vehicles is a most important factor in its spread. Smoke-houses have been erected at various points, and these, especially when situated within a cleared area (thus preventing the fly from simply leaving the car as it enters the house and rejoining it on its exit), are proving valuable factors in control. The houses are constructed of grass and poles, like the native houses, with a grass thatched roof, and when the car is driven in, light reed mats are dropped over the doors. Damp foliage is then placed on the embers of a portable blacksmith's forge in a corner of the house and a draught gently induced, so that a large volume of smoke is produced in a short time. After five or seven minutes, during which no serious discomfort is experienced, the car continues on its way, no flies ever being found on emergence from the smoke-house.

A postscript records the recent finding of a few individuals of *G. morsitans* to the west of Lake Nakivali in an area from which it was thought to have retired after the War, the average catch along the banks of a dried-up water-course being 4 or 5 an hour.

FREW (J. G. H.). **Tsetse Fly Survey. Report for October-December, 1927.**—*Rep. Lds. For. Dept. Sierra Leone 1927*, p. 21. Freetown, 1928.

A tsetse-fly survey of certain parts of Sierra Leone, carried out from October to December 1927, showed that *Glossina palpalis*, R.-D., was widely distributed but not numerous. *G. fusca*, Wlk., was found in

several localities. The habitat of this species differs from that of *G. palpalis* in that the immediate vicinity of water is not essential to it. It usually occurs in thick forest, bush or scrub and is never encountered far from dense shade of some sort ; it is most common along native or game paths, but has been found in a few instances where there was no obvious indication of either.

Hegh (E.). **Les tsé-tsés. Tome 1er.**—Super royal 8vo, xiv+742 pp., 15 col. pls., 327 figs. Brussels, Ministère des Colonies, 1929. **Price 70 Belgas.**

In this work the author has collated all the more important published information on tsetse-flies (*Glossina*), many papers being translated or reproduced *in extenso*, his aim being to provide a comprehensive treatise in French that will be of use to all persons in Africa concerned with any aspect of the tsetse-fly problem. The present volume deals with the anatomy, classification, reproduction, breeding-places and natural enemies. The second volume will deal with geographical distribution, biology and ecology of the adults, methods of control and technique.

The first chapter contains general and miscellaneous information, including historical notes from the works of explorers up to the end of the nineteenth century. In the second and third chapters descriptions of the structure of the mouth-parts and the anatomy, by various authors, are given. The next three chapters are devoted to classification ; chapter iv is a review of the taxonomic work on the genus *Glossina*, and includes reproductions of the original descriptions published prior to 1900 ; chapters v and vi are systematic accounts of all the species of *Glossina*, according to the classifications of Austen and Newstead respectively, all the detailed descriptions contained in Austen's "Handbook" of 1911 and in the "Guide" of Newstead and his collaborators *R.A.E.*, B, xii, 185 being translated, and the original plates and figures being reproduced ; four coloured plates of species not illustrated in Austen's "Handbook" have been specially prepared for this work. The last three chapters deal respectively with reproduction, breeding grounds and natural enemies.

A chronologically arranged bibliography for the three chapters on classification is given at the end of chapter vi ; each of the other chapters has its own bibliography arranged by authors.

Hoffmann (C. C.). **Nota acerca de un probable transmisor de la trypanosomiasis humana, en el estado de Veracruz.** A Note on a probable Carrier of Human Trypanosomiasis in the State of Veracruz.—*Rev. mexicana Biol.*, viii, no. 1, reprint 7 pp., 6 figs. **Mexico, D.F., January–February 1928.**

The Reduviid, *Triatoma* (*Conorhinus*) *dimidiata*, Latr., occurs in the Mexican state of Veracruz, together with its variety, *maculipennis*, Stal. It is a probable vector of Chagas' disease there, though no cases have been recorded officially. In countries further south its natural infection with *Trypanosoma* (*Schizotrypanum*) *cruzi* is well known, and two animals that are natural reservoirs of the trypanosome, the armadillo and *Didelphys virginiana*, occur in Veracruz.

DELANOË (P.). **Présence de l'Ornithodore du Maroc dans les terriers de porcs-épics et de renards et dans les habitations humaines. Son existence au Maroc oriental. Fréquence d'un spirochète récurrent chez les Ornithodores des terriers.**—*C. R. Acad. Sci. Fr.*, clxxxviii, no. 15, pp. 1013–1015, 3 refs. Paris, 1929.

Confirmation of the belief that rodents are the natural hosts of *Ornithodorus marocanus*, Velu, in Morocco [*R.A.E.*, B, xvi, 219] was obtained by finding this tick in 19 out of 21 porcupine burrows examined. An undetermined tick of this genus was also found in one burrow. *O. marocanus* was frequently found in foxes' dens, some of which also harboured the other species. Many of these burrows, etc., were in situations where no pigs had been bred, thus showing that this tick is quite independent of these animals. It is capable of living normally on man and does not use him only as an occasional host, as has been previously believed ; in one locality it was found in native huts, etc. *O. marocanus*, from both porcupine burrows and foxes' dens, was frequently infected with spirochaetes and, when transferred to guinea-pigs, caused relapsing fever in 50 per cent. of the cases. Of 14 pig farms distributed over a large area, only one contained infective ticks, in spite of the proximity of porcupine burrows containing them. From this the author concludes that the ticks do not readily spread from the burrows. The extreme sensitiveness of guineapigs to the spirochaete of the ticks from the burrows suggests that it is *Spirochaeta hispanica* var. *marocana*. As this tick has been recorded from various pig farms in eastern Morocco, it is likely that it also occurs in Algeria.

COOLEY (R. A.). **Tick Parasites—Executive Report.**—*7th Bienn. Rep. Montana State Bd. Ent.*, pp. 10–16. Helena, Mta. [1929.]

An account is given of the progress made in Montana in the breeding of the introduced Encyrtid parasite, *Ixodiphagus caucurtei*, du Buysson, for use against *Dermacentor venustus*, Banks (*andersoni*, Stiles). A supply of female ticks was secured in the spring of 1927 from which 250,000 nymphs were obtained in September for the maintenance of the stock of parasites in 1928. In the early spring the nymphs, which had been kept in tubes or cages under approximately natural conditions, were placed on laboratory animals together with living adult parasites, which lay their eggs in the ticks. The ticks engorge and drop off into the infesting bags, from which they are recovered and kept at favourable temperatures. The parasitised nymphs are eventually put into separate tubes, and the others develop normally and produce adults. Studies are being carried out to discover to what extent the parasite can withstand the severe climate of Montana and adapt itself to the habits of *D. venustus* ; whether the parasite can use another tick as an alternative host in summer and early autumn, nymphs of *D. venustus* being scarce after mid-July ; the rapidity with which the parasites can multiply and spread ; and the most effective method of liberating them. Wild rodents were captured, infested with parasitised ticks and again released in the locality in which they were captured. Tubes containing parasites were left attached to small balls of cotton, which pack rats [*Neotoma*] and ground squirrels [*Citellus*] are likely to carry to their nests in the vicinity of mountain goats, known as important hosts of adult ticks. Parasites were also liberated at feeding places previously established artificially for rabbits when their food was scarce, or were left near the haunts or tracks of various wild rodents.

An expedition is to be made to study the habits of tick parasites and their hosts in Africa, which is probably the country of origin of the three known species.

Hunterellus hookeri, How., an Encyrtid closely allied to *Ixodiphagus* was secured in 1927 from two consignments of nymphs of *Rhipicephalus sanguineus*, Latr., received from Texas, where it was originally discovered in 1908. In less than a year *H. hookeri* became established in the laboratory on *D. venustus*, its habits being similar to those of *I. caucurtei*. It is intended to establish colonies of parasites as soon as possible in the various districts in which Rocky Mountain spotted fever occurs.

Cooley (R. A.). **Preliminary Report on the Tick Parasite,** *Ixodiphagus caucurtei* **du Buysson.**—*7th Bienn. Rep. Montana State Bd. Ent.*, pp. 17–31, 8 figs., 5 refs. Helena, Mta. [1929.]

A review of the literature shows that three species of tick parasites are known. *Ixodiphagus texanus*, How., was reared from *Haemaphysalis leporis-palustris*, Pack., in Texas in 1907 and has not been observed since. *Hunterellus hookeri*, How., was described from Texas, and *I. caucurtei*, du Buysson, from France. *H. hookeri* has also been recorded from California, Mexico, Cuba, southern India, Indo-China and Portuguese East Africa. All these parasites have been found feeding in nymphal ticks only, with the exception of one record of *H. hookeri* emerging from adults, and the parasitised nymphs were all found feeding on their animal hosts. The Texas species were both taken in the spring and the French species in the autumn. *H. hookeri* has been reared from *Rhipicephalus texanus*, Banks, *R. evertsi*, Neum., *R. sanguineus*, Latr., and *Dermacentor parumapertus marginatus*, Banks; and *I. caucurtei* from *Ixodes ricinus*, L., *Haemaphysalis concinna*, Koch, *R. sanguineus*, *D. venustus*, Banks (*andersoni*, Stiles) and *D. variabilis*, Say [*cf. R.A.E.*, B, xvi, 133].

From observations in the laboratory, notes are given on the method of oviposition of *I. caucurtei*, and the egg is described. No exact work has been done to determine how many eggs a female may lay, but the number is probably very large. Dr. Brumpt found that from 5 to 10 eggs were laid at each insertion of the ovipositor. Two parasites may oviposit in one nymph, although one parasite rarely oviposits twice in the same host. Since females in the laboratory have been seen to oviposit in fed larvae (xvi, 162), and in starved as well as in fed nymphs, it is possible that the eggs may be laid in nature in stages other than the nymph, and it is desirable to determine whether adaptations occur by means of which the species may survive periods of the year when nymphal ticks are not to be found on their hosts.

The ticks, which continue to feed and develop undisturbed by the act of oviposition, are fed on rabbits, etc., in wire cages enclosed in bags of unbleached muslin in a room kept at about 75° F. The rate of parasitism is often 80 per cent. The temperature at which the highest percentage of nymphs develops successfully and produces adult parasites is 22° C. (71·6° F.). At this temperature the period from the dropping of the fully fed nymph to the first indication of parasitism averages 18½ days, and that from dropping to emergence of the parasite 45 days. Parasitised nymphs kept at 12° C. (53·6° F.), did not produce adult parasites, though parasites were still alive after 7 months. No adults emerged at 33° C. (91·4° F.), the temperature being too high. Details

are given of observations of the development within the tick. Under laboratory conditions the number of parasites to emerge from a single tick varied from 4 to 66. The size of the parasites varies inversely with the number to derive their food from one tick.

An attempt to maintain the stock of parasites, chiefly in the pupal stage, at lowered temperatures (12 and 17° C. [53·6 and 62·6° F.]) with the object of inducing hibernation failed, and the parasites died off rapidly. It appears that the species is primarily adapted to continuous development throughout the year and may be kept breeding slowly at 53·6° F. during the winter. This would suggest that the insect is of tropical or sub-tropical origin and was probably introduced into France. Although adults died in from two to four days at room temperature, those placed upon emergence at 2–6° C. [35·6–42·8° F.] survived from 12 to 19 days, and there are indications that the parasites may survive much longer in a state of nature. Laboratory studies indicate that the parasite requires continuous supplies of nymphs in which to lay eggs during the summer months and that it will be necessary for it to become inactive without special adaptation for hibernation through a protracted period of unfavourable temperatures during the winter if successful colonisation is to be effected. A detailed comparison of the respective climates shows that much lower air temperatures prevail in winter at various points in Montana than in Paris where *I. caucurtei* is known to be more or less well established.

MORTON (F. A.). **Quantity Production of Tick Parasites.**—*7th Bienn. Rep. Montana State Bd. Ent.*, pp. 32–35. Helena, Mta. [1929.]

This paper describes the technique of rearing *Dermacentor venustus*, Banks (*andersoni*, Stiles) and its parasite, *Ixodiphagus caucurtei*, du Buysson [see preceding papers]. An average of 20 parasites is obtained from each nymph and 70 per cent. parasitisation. Parasites emerge from approximately 80 per cent. of the parasitised nymphs under conditions of fairly high humidity, but are unable to emerge if the nymphal shell becomes dry or brittle.

PARKER (J. R.) & BUTLER (W. J.). **Tick Parasite Liberation in Montana during 1928.**—*7th Bienn. Rep. Montana State Bd. Ent.*, pp. 35–38. Helena, Mta. [1929.]

From the original stock of 27 nymphal ticks parasitised by *Ixodiphagus caucurtei*, du Buysson, brought to Montana in 1926 [*R.A.E.*, B, xv, 216] a total of 381,190 parasites was released during the summer of 1928, and a sufficient reserve was maintained to provide a much larger supply in 1929. When the adult parasites are liberated, they seek rodents and other small animals that harbour nymphs of *Dermacentor venustus*, Banks (*andersoni*, Stiles), in which they oviposit. From 5 to 10 eggs are generally laid at each insertion of the ovipositor, and although the female may oviposit repeatedly in the same nymph she usually goes in search of others. More than one female may lay eggs in one nymph. The larvae feed on the tissues of the nymphal tick, in the body of which they pupate. Nymphs used for the rearing of parasites are bred from ticks collected in districts where neither spotted fever, tularaemia nor tick paralysis has ever been known to occur. Parasitised nymphs are placed in glass vials with wire gauze placed over the open ends of such a mesh as to allow of the escape of the parasites on emergence. These

vials are then placed in and around the nests and holes of rodents known to harbour the nymphal stage of *D. venustus*, sometimes attached to cotton or bright articles to attract animals such as pack rats and cause them to carry them to their nests. The other method of distribution is to allow newly parasitised nymphal ticks to attach themselves to trapped rodents, which are then liberated in the locality in which they were caught. The nymphal ticks when fed drop from rodents in their burrows, where the parasites develop and find tick-infested rodents available on emergence.

Areas for the liberation of *I. caucurtei* were selected on the basis of the previous distribution of Rocky Mountain spotted fever in Montana, and the selection of points within these areas was made in relation to the abundance of adult ticks and various small rodents known to act as hosts of the nymphs. In the laboratory the number of parasites emerging from one nymphal tick varies from 2 to 73, the average of 100 nymphs taken at random in one experiment being 21. In estimating the number of parasites liberated, however, 14 has been taken as the average number of adult parasites emerging from each parasitised engorged nymph. The ability of *I. caucurtei* to withstand the winter under outdoor conditions in Montana has been demonstrated in an experiment in which parasites emerged on 23rd May 1928 from 3 out of 48 nymphs that dropped in September 1927; these had been transferred to longevity tubes and placed in the ground on 1st October after being kept for a time at 19° C. [66·2° F.] in the laboratory, into which they were brought again on 11th April 1928. The parasite has also been recorded as surviving the winter under natural conditions on Naushon Island, where it subsequently reproduced [*R.A.E.*, B, xvi, 133].

PARKER (R. R.). **Rocky Mountain Spotted Fever.**—*7th Bienn. Rep. Montana State Bd. Ent.*, pp. 39-62, 1 map, 4 pp. refs. Helena, Mta. [1929.]

A comprehensive account is given of the present position in regard to Rocky Mountain spotted fever and the recent progress made in its control. The control of the disease is only a part of the larger problem of the control of its vector, the wood tick, *Dermacentor venustus*, Banks (*andersoni*, Stiles), which also causes tick paralysis in man and animals, tularaemia, and in some parts of Wyoming and Colorado at least seems to transmit yet another infection, an intermittent type of fever of unknown etiology.

Evidence hitherto secured indicates that stage to stage transmission of the virus of Rocky Mountain spotted fever occurs within each successive generation of the tick carriers; that hereditary transmission takes place from one generation to the next; and that new lines of tick infection are started each year in each generation through the medium of tick-infested small mammals. The successful flow of the virus along any of these channels is dependent upon varying factors of several orders. Of primary importance are tick abundance and those practically unknown factors affecting the survival and virulence of the virus in the ticks. Tick abundance is governed by secondary factors such as climatic conditions and host availability. The species of animal hosts present, their abundance, distribution and habits are predetermined by a third order of factors such as floral associations, local topography, climatic conditions and the character and degree of development of local agriculture.

The most important discovery in recent investigations is the demonstration in 1921 of the transmission of the virus by the rabbit tick, *Haemaphysalis leporis-palustris*, Pack. [*R.A.E.*, B, xi, 68]. Later observations have shown that stage to stage and hereditary transmission of the virus also occur in this tick. Recent findings concerning *H. leporis-palustris*, which has hitherto been studied only in the Bitter Root Valley, indicate that it plays an important part in the distribution of the virus and increases the number of virus-containing wood ticks, since *D. venustus* occurs with the rabbit tick on the same hosts. Infestation of its hosts by *H. leporis-palustris*, which varies in degree according to the habitat adaptations of each host species, is often very heavy, 100 per cent. of snowshoe rabbits [*Lepus bairdi*] examined having been found infested in some seasons, and several hundred ticks being present on each animal examined. Infestation in grouse varied from 18–75 per cent., from 25–50 ticks being carried by a single bird. The percentage of infested hosts carrying infected ticks varied from 27·27 to 38·64 per cent. in various species of rabbit and 20–50 per cent. in grouse. The percentage of infection in *Dermacentor* is higher in places where rabbits occur. *H. leporis-palustris*, when recovered in nature, carried a strain of spotted fever virus so mild that it seldom produces typical, or even recognisable, lesions in experimental animals. It remains to be determined whether the presence of infection in any given locality is dependent upon primary infection in *D. venustus* or *H. leporis-palustris*, or whether each species can maintain infection independently of the other. The limits of the present endemic area, as delineated by human cases, is well within the range of *D. venustus*. *H. leporis-palustris* has a much wider distribution, and if it were the original vector, it should be possible to recover infection at points well beyond the range of *Dermacentor*, but no attempt to do so has yet been made. It has been subsequently proved that both *D. venustus* and *H. leporis-palustris* are natural carriers of *Bacterium tularense*, and that the former is an important agent of human infection with tularaemia.

The following possibilities are pointed out in connection with the maintenance of the virus : the existence of chronic infection in one or more species of susceptible tick ; transmission of virus from male to female ticks, which would enhance the importance of hereditary transmission ; and transmission of the virus by parasites other than the two ticks already observed. Transmission has already been demonstrated through adults of *Dermacentor albipictus*, Pack., and *D. parumapertus marginatus*, Banks, infected as nymphs, and nymphs of *D. variabilis*, Say, infected as larvae. The range of the last two is, within certain limits, concurrent with that of *D. venustus*.

Most of the information given in regard to the distribution and spread of Rocky Mountain spotted fever from 1914 to 1928 has already been noticed [*R.A.E.*, B, xv, 217]. Cases are being reported from new localities each year sufficient to justify the belief that both intensive and extensive spread is taking place. It is suggested that spotted fever virus in an avirulent phase, in which the specific agent invades the host without the causation of clinical evidence of infection, has been more generally distributed throughout the Rocky Mountain fever region than human occurrence would indicate, and that apparent new foci, as indicated by first case occurrence, may in reality be sections in which changing environmental conditions have transformed an avirulent type of virus into one infectious to man. Such an avirulent phase exists on

the eastern side of the Bitter Root Valley, where unfed wood ticks were collected in 1922, 1923 and 1928 which, though they failed to produce spotted fever when tested by the feeding and inoculation methods, showed an immunising phase of the virus.

The indirect effect of all the factors noted in virus incidence results in a more or less definite, though irregular, cycle of case abundance. The peaks of occurrence in each separate focus within a given area are, however, not necessarily chronologically coincident. In areas of considerable case incidence a marked decline of cases occurs during prolonged dry periods. Seasonal incidence is restricted by the period of tick activity and is at its height between March and June. Cases have, however, been reported during all months of the year, winter cases usually coming from mountain areas. The virulence of the disease, as represented by the death rate is reasonably constant year after year, the mortality among cases in the Bitter Root Valley, the focus of greatest virulence, being 75 per cent. for the period 1917–1926. In regions where the mildest type of infection prevails, mortality seldom exceeds 5 per cent. It is suggested that fluctuations in the number of susceptible small mammals through which infection is being passed may account for periodic variations of virulence. The author is in agreement with Wolbach, the results of whose experiments he has confirmed, that the causal agent of Rocky Mountain spotted fever is *Dermacentroxenus rickettsi* [*R.A.E.*, B, xiv, 103], and has found nothing to justify the theory that such organisms are the product of cellular digestion [*R.A.E.*, B, xi, 86].

The properties of the virus in the blood of animals or man remain essentially constant throughout an indefinite number of animal passages and are always infectious and never immunising. In ticks, on the other hand, the virus alternates between a non-symptom and immunity producing phase that is present in aestivating and hibernating ticks and an extremely virulent, infectious phase, which in each successive stage of the tick follows the ingestion of fresh blood (reactivation). Tick-virus, which possesses the faculty of infecting through unabraded skin, is 200 to 3,000 times more concentrated than blood-virus, which does not possess this faculty. Blood-virus alone, whether killed or attenuated by heat or chemicals, does not immunise, but tick virus when killed by phenol, formalin, chloroform or alcohol, has a high protective value. A transition period occurs in previously non-infected ticks following the ingestion of blood-virus, which loses its original characteristics and takes on those of the tick-virus. This is followed by a period during which the virus becomes generally distributed throughout the tick tissues. During this time, which may be a matter of either days or weeks, the tick is unable to transmit infection by feeding. These phenomena of transition and invasion are probably more rapid in the larva or nymph, since in them the distribution of the virus is likely to be facilitated by tissue changes, so that it can reach more rapidly the salivary glands, through which infection is transmitted.

In the majority of cases human infection can be traced to tick bite from 2 to 12 days before the onset of the disease, but experiments have shown that tick-virus would infect if merely dropped among the hairs of the unabraded skin, or into the eyes of guineapigs. Tick excrement has also been demonstrated to be frequently infectious.

Preventive measures include those for the control of *D. venustus* and personal prophylaxis. Efforts to control the tick have hitherto been confined to the Bitter Root Valley, and since recent investigations

have shown that the most fundamental factors of maintenance affecting the prevalence of infection in the valley originate in the mountains that border it on the west, the first aim should be to shut off the flow of infection. The elimination of the Rocky Mountain goat, which has been found to be the chief host of the adult ticks, is the most important single step to be taken, and much is hoped from the distribution of *Ixodiphagus caucurtei*, du Buysson. Persons exposed to average danger should examine the clothing and body for ticks twice a day. The ticks usually crawl about for some time before attaching themselves and are seldom able to infect until some hours after feeding has begun, since the virus does not become infective until reactivated. Owing to the impossibility of securing complete protection vaccination is now being recommended, and improved methods of preparing the vaccine from ticks [*cf. R.A.E.*, B, xv, 217] are discussed. It usually confers full protection against the milder types of spotted fever and ordinarily ensures recovery from the virulent type, but it is costly and any considerable degree of protection rarely exceeds a year.

PAPERS NOTICED BY TITLE ONLY.

DYAR (H. G.). **Remarks on the Subgenus *Phalangomyia* of *Culex* Linn. (Diptera, Culicidae)** [including two new Species].—*Amer. J. Hyg.*, ix, no. 2, pp. 509–511. Baltimore, Md., March 1929.

MITROFANOVA (J.). **On the Growth of the Head in the Larva of *Anopheles maculipennis*, Meig.**—*Bull. Ent. Res.*, xix, pt. 4, pp. 361–366, 2 figs. London, March 1929.

DE MEILLON (B.). **The Early Stages and Male Hypopygium of *Anopheles argenteolobatus*, Gough.**—*Bull. Ent. Res.*, xix, pt. 4, pp. 401–404, 3 figs., 2 refs. London, March 1929.

SAMTLEBEN (B.). **Zur Kenntnis der Histologie und Metamorphose des Mitteldarms der Steckmückenlarven.** [A Contribution to the Knowledge of the Histology and Metamorphosis of the middle Intestine of Mosquito Larvae.]—*Zool. Anz.*, lxxxi, no. 5–6, pp. 97–109, 5 figs. Leipzig, 15th April 1929.

LÉGER (L.) & DUBOSCQ (O.). *Harpella melusinae* **n.g., n. sp. Entophyte eccriniforme parasite des larvaes de simulie** [*Simulium ornatum*, Mg.].—*C.R. Acad. Sci. Fr.*, clxxxviii,, no. 14, pp 951–954, 6 figs. Paris, 1929.

MOTE (D. C.). **The Reproductive System of the Warble Fly, *Hypoderma bovis* DeGeer.**—*Ann. Ent. Soc. Amer.*, xxii, no. 1, pp. 70–76, 4 pls., 5 refs. Columbus, Ohio, March 1929.

EWING (H. E.). **Notes on the Siphonapteran Genus *Catallagia* Rothschild, including the Description of a new Species.**—*Proc. Biol. Soc. Wash.*, xlii, no. 8, pp. 125–127. Washington [D.C.], 30th March 1929.

[PAVLOVSKIĬ] PAWLOWSKY (E. N.). **Die Giftigkeit im Tierreich und die Gift produzierenden Organe.** [Poisonousness and Poison-producing Organs in the Animal Kingdom.]—*Seuchenbekämpfung*, vi, no. 1, pp. 40–48. Vienna, 1929.

SHARIF (M.). **A Revision of the Indian Ixodidae with special Reference to the Collection in the Indian Museum.**—*Rec. Ind. Mus.*, xxx, pt. 3, pp. 217–344, 2 pls., 49 figs., 4 pp. refs. Calcutta, October 1928.

OUDEMANS (A. C.). *Aponomma komodoense* **nov. spec.**—*Zool. Meded.*, xi, pt. 4, pp. 227–231, 2 pls. Leyden, 31st December 1928.

PARKER (R. R.). **Rocky Mountain Spotted Fever in Montana, 1927-1928.**—*7th Bienn. Rep. Montana State Bd. Ent.*, pp. 63–67, 1 map. Helena, Mta. [1929.]

During the two years following the publication of the previous report [*R.A.E.*, B, xv, 216], 64 cases of Rocky Mountain spotted fever occurred in Montana, 35 in 1927 and 29 in 1928. In the half of Montana east of the Rocky Mountains, where infection was unknown except at one point prior to 1914 and has since spread over an area of 30,000 sq. miles, cases occurred in new localities.

PARKER (R. R.). **Vaccination against Rocky Mountain Spotted Fever.**—*7th Bienn. Rep. Montana State Bd. Ent.*, pp. 68–69, 1 ref. Helena, Mta. [1929.]

Additional data secured since the results of the first two years' use of the vaccine were reported [*R.A.E.*, B, xv, 217] are given to demonstrate the definite prophylactic value of vaccination for the prevention of Rocky Mountain spotted fever. In a test carried out over a four-year period in the Bitter Root Valley against the virulent type of infection, over 2,000 persons were vaccinated, including a group of highly exposed laboratory workers. Of 30 cases of infection, 12 were vaccinated and 18 unvaccinated, the death rate among the former being 8·33 per cent., and among the latter 83·44 per cent.

O'DONNELL (F. J.). **Control Work : Rocky Mountain Spotted Fever Control Districts, Bitter Root Valley, 1927-1928.**—*7th Bienn. Rep. Montana State Bd. Ent.*, pp. 70–75, 1 graph. Helena, Mta. [1929.]

Measures against Rocky Mountain spotted fever during 1927 and 1928 have been carried out on the same lines as those recorded in the previous report [*R.A.E.*, B, xv, 216], and were confined principally to rodent control and stock dipping. In some of the controlled districts during the past 16 years a decrease has occurred in the number of cases. Although other factors have contributed to the decrease of the disease, the great reduction in rodents over large areas and the resultant very apparent decrease of ticks is considered full justification for the money and effort expended.

COOLEY (R. A.). **Montana's Laboratory for the Study of Insect-borne Diseases.**—*7th Bienn. Rep. Montana State Bd. Ent.*, pp. 86–88. Helena, Mta. [1929.]

The new laboratory of the Montana State Board of Entomology, an account of which is given in this paper, has been erected under an appropriation of £12,000 made in 1927. Although it is planned generally for the field of medical entomology, interest is concentrated for the present on the immediate problem of the local wood tick, *Dermacentor venustus*, Banks (*andersoni*, Stiles), and the diseases of man and losses of livestock caused by it. It is hoped that much better protection for workers will be afforded in the new building.

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PARKER (R. R.) & BUTLER (W. J.). **Results of Preliminary Investigations in Montana of pathological Conditions in Sheep due to the Wood Tick,** *Dermacentor andersoni* **Stiles.**—*7th Bienn. Rep. Montana State Bd. Ent.*, pp. 77–85, 6 refs. Helena, Mta. [1929.]

This paper gives details of observations carried out in Montana in 1923 and 1925, which suggest that tularaemia may have been responsible, at least in part, for losses incurred among sheep under investigation. Although there appears to be no doubt that *Dermacentor venustus*, Banks (*andersoni*, Stiles) played an initiating part in the disease outbreaks reported upon, the relative extent to which tick paralysis and tularaemia are responsible for the resultant pathology is not clear. The possibility that tick paralysis is concerned rests solely upon observations of the actions of affected sheep and their more or less rapid recovery when infesting female ticks were removed soon after symptoms were noted. Evidence of the possible responsibility of tularaemia is entirely circumstantial. It appears highly probable that the death of jack rabbits reported in 1923 coincident with the disease in sheep was due to tularaemia, and present knowledge would justify the assumption that the death of 5 guineapigs, each infected by a single tick taken from affected sheep was caused by this infection. Some at least of these five ticks may have acquired the disease from the sheep on which they were feeding, as it would be extremely unlikely that so high a percentage of unfed ticks selected at random would be infected.

In 1925, tularaemia-infected ticks were recovered from each of the three flocks under observation, but there was no evidence to show that they had transmitted *Bacterium tularense* to the sheep. Serum recovered from a diseased sheep, however, agglutinated *B. tularense* in dilution 1 : 640, which in conjunction with the Idaho tests in 1928 [see next paper] justifies the opinion that *B. tularense* was concerned in this case. In another flock, on the contrary, although tularaemia-infected ticks were recovered from sheep, sera from four supposedly recovered ewes failed to agglutinate *B. tularense* even in low dilutions. Symptoms observed in the affected eastern Montana flocks also fail to agree with those observed in southern Idaho. Although it is possible that tick paralysis and tularaemia in sheep may be one and the same condition, present evidence is against this hypothesis.

PARKER (R. R.) & DADE (J. S.). **Tularaemia in Sheep in Nature.**—*Pub. Hlth. Rep.*, xliv, no. 3, pp. 126–130, 6 refs. Washington, D.C., 18th January 1929.

In experiments carried out in Idaho in 1928, positive tests, indicative of present or recent infection with *Bacterium tularense*, were secured from each of eight sheep found diseased under natural conditions, the findings being bacteriologically confirmed in two instances. The disease was transmitted to guineapigs by feeding and injection of ticks, *Dermacentor venustus*, Banks (*andersoni*, Stiles) from the affected sheep, and also by injecting tissues from the latter.

[OLENEV (N. O.).] **Оленев (Н. О.). Sur la classification et la distribution géographique des Ixodides, iii.** [*In Russian.*]—*C.R. Acad. Sci. U.R.S.S.*, 1929, no. 2, pp. 43–48, 2 figs., 5 refs. Leningrad, 1929.

From a further examination of the collection of Ixodids in the Zoological Museum of the Academy of Science in Leningrad [*R.A.E.*,

B, xvi, 184], the author considers that three species of *Rhipicephalus* occur in the Russian Union, *viz.*, *R. sanguineus*, Latr., of which he regards *R. rossicus*, Yak. & Kohl-Yak., as a synonym [*cf. R.A.E.*, B, xi, 190], *R. bursa*, Can. & Fanz., and *R. schulzei*, sp.n., which occurs to the north-west and east of the Caspian on camels, ground squirrels (*Citellus*) and polecats.

Ticks of the genus *Boophilus* have been recorded from the Crimea, Caucasus and Russian Central Asia on cattle ; all the specimens in the collection under review are *B. annulatus calcaratus*, Bir., which the author is provisionally inclined to consider a distinct species.

[Buichkov (V. A.) & Borzenkov (A. K.).] **Бычков (В.А.) и Борзенков (А.К.). The Diagnosis of Plague Infection in Fleas by Preparation of the Digestive Tract and Cultures.** [*In Russian.*]—*Rev. Microbiol. Epidemiol. Parasitol.*, viii, no. 1, pp. 20–32, 14 figs., 14 refs. Saratov, 1929. (With a Summary in English, pp. 112–113.)

This is a detailed description of a new method for the diagnosis of plague infection in fleas by microscopic examination of the digestive tract. It was found that the deformation of the proventriculus caused by blocking with plague bacilli proves the infection of the flea, and in cases of doubt this can be confirmed by making a culture of an emulsion from the alimentary tracts of other fleas with similar deformations. The existing methods of determining the infection of fleas by making cultures from their excreta or observing the act of regurgitation of the flea during the process of sucking are discussed in detail, and the advantages of the new method are pointed out. The fleas used for experiment were *Ceratophyllus tesquorum*, Wagn., *Ctenophthalmus pollex*, Wagn., *C. breviatus*, Wagn. & Ioff, and *Neopsylla setosa*, Wagn., which were collected at various periods in the Stalingrad Government from the nests of ground squirrels [*Citellus*] in localities where epizootics of plague occurred.

Williams (C. L.). **A Rat and a Rat-Flea Survey of Ships at the Port of New York.**—*Publ. Hlth. Rep.*, xliv, no. 9, pp. 443–476, 1 chart, 10 refs. Washington, D.C., 1st March 1929.

An investigation was carried out from 1st September 1925 to 31st August 1927 to obtain accurate information concerning the rats and rat fleas in ships at the port of New York and the factors influencing their prevalence. The majority of ships carry few rats, and from a quarantine standpoint about 50 per cent. of the ships arriving at New York constitute about 90 per cent. of the potential plague menace. Only about 10 per cent. are heavily infested (over 30 rats), and these are really the potentially dangerous vessels.

Only two species of rat flea are found in ships in sufficient numbers to be of importance in the transmission of plague, namely *Xenopsylla cheopis*, Roths., and *Ceratophyllus fasciatus*, Bosc. Failure to find any but occasional individuals of other species is evidence of their lack of adaptability to conditions on board ship, and this largely accounts for the restrictive localisation of some species and the wide-spread dissemination of *X. cheopis* and *C. fasciatus*. In vessels from ports north of 40°N. Lat. *C. fasciatus* is almost the only rat flea found, a fact that places

them in a separate class of lower potential plague menace than ships from other ports, in which *X. cheopis* is markedly predominant. The most heavily infested rats are in ships from the ports of the Caribbean Sea and adjacent localities and in ships from the east coast of South America; the lowest infestation occurs in ships from the west coast of South America and from (only 13 ships observed) Australia. Only one flea was found on 344 rats taken from 93 sugar-carrying vessels.

Fleas on rats killed with hydrocyanic acid gas are much fewer in cold weather than in warm weather. The material used in fumigation largely influences the number of fleas secured; with Zyklon B (100 per cent. HCN to which chloropicrin to the amount of 3–5 per cent. of the HCN has been added as a warning gas) more than half and less than two-thirds as many fleas per rat were secured as were found on rats killed by 80 per cent. HCN and 20 per cent. CNCl (cyanogen chloride) generated as a gas or sprayed as a liquid respectively. Evidently a higher proportion of fleas leaves the rats when Zyklon is used, but there is no reason to suppose that they escape destruction; the difference in the character of the warning gas may be the determining factor. The increase in the numbers of rats in a ship does not in general appear to increase the relative infestation, and rats in individual ships may or may not be heavily infested, 562 fleas being taken from 61 rats in one ship while no fleas were found on 128 rats in another.

MAYER (M.). **Die Uebertragungsweise der infektiösen Rattenanämie.** [The Method of Transmission of infectious Rat Anaemia.]—*Klin. Wschr.*, vii, no. 50, pp. 2390–2391. Berlin, 9th December 1928.

Bartonella muris, which causes infectious anaemia in rats but is normally only pathogenic after removal of the spleen, was experimentally transmitted by the rat louse, *Polyplax* (*Haematopinus*) *spinulosus*, Burm.

RODHAIN (J.). **Larves d'Oestrides cavicoles chez** *Okapia johnstoni* **Scl.**—*Rev. zool. afr.*, xiv, no. 1, pp. 137–139, 1 ref. Brussels, 15th August 1926.

The author describes two Oestrid larvae removed from the frontal sinuses of an okapi (*Okapia johnstoni*) that died in the Zoological Gardens at Antwerp six weeks after its arrival from the Belgian Congo. He concludes that these larvae were those of *Cephalomyia* (*Oestrus*) *ovis*, L., and that the animal became infested in the Congo, where it was kept in localities in which there were sheep and goats. *C. ovis* has previously been recorded from various species of antelope in East Africa.

MÖSCHLER (—). **Die Larven der Elchrachenbremse** *Cephenomyia ulrichi*. [The Larvae of *C. ulrichi*.]—*Schr. phys.-oekon. Ges. Königsberg*, lxv, no. 3–4, pp. 253–254. Königsberg i. Pr., 1929.

The adults of *Cephenomyia ulrichi*, Brauer, occur from the end of May to the end of August in Kurland and deposit their larvae in the nostrils of the elk, where they remain for some months before attaching themselves in the throat. The number of larvae found in each host examined

averaged 30–40. About the middle of April the first larvae are full grown and leave their host to pupate, this stage lasting from 21 to 40 days, according to the temperature. Complete larval development takes 11–12 months, and during three months the larvae of two generations may be found in the same host.

HARDENBERG (J. D. F.). **Beiträge zur Kenntnis der Pupiparen** [Contribution to the Knowledge of the Pupipara.]—*Zool. Jahrb.*, Abt. Anat., l, no. 4, pp. 497–570, 19 figs., 78 refs. Jena, 9th March 1929. Also as **Bijdrage tot de kennis der Pupipara.**—Utrecht, Thesis, 1927.

This paper deals fully with the embryology and anatomy of the female genitalia of the four families of Pupipara, HIPPOBOSCIDAE, NYCTERIBIIDAE, STREBLIDAE and BRAULIDAE, and includes notes on their general morphology and post-natal development.

JOHNSON (C. W.). **The Injury to Nestling Birds by the Larvae of** *Protocalliphora*.—*Ann. Ent. Soc. Amer.*, xxii, no. 1, pp. 131–135, 12 refs. Columbus, Ohio, March 1929.

Previous literature dealing with the effect of larvae of *Phormia* (*Protocalliphora*) on nestling birds is briefly reviewed, the species recorded from birds' nests in America being distinct from the European ones. Various recent reports of infestation of birds by these flies in the United States are given ; the records show that the presence of the larvae is a serious menace to nestling birds, and measures should be taken to stop their depredations. It is suggested that where nests are accessible, such as in bird houses, the first nests should be destroyed as soon as the nestlings have left ; with the second brood, about a month's interval should be left before destroying the nests to allow the parasites of the flies to escape.

RILEY (W. A.). **The Teaching of Medical Entomology.**—*Ann. Ent. Soc. Amer.*, xxii, no. 1, pp. 136–141. Columbus, Ohio, March 1929.

The author discusses some of the problems connected with the teaching of medical entomology and indicates in broad outline the manner in which he has tried to meet them. He urges the necessity of a knowledge of current literature and an appreciation of pioneer work, and points out that the student should also have preliminary preparation in many branches of science bearing on the subject.

ROSS (I. C.). **Observations on the Hydatid Parasite** (*Echinococcus granulosus*) **and the Control of Hydatid Disease in Australia.**—*Bull. Council Sci. Ind. Res. Australia*, no. 40, 63 pp., 4 figs., 4 pp. refs. Melbourne, 1929.

Since experiments show that flies ingest eggs of *Echinococcus granulosus*, the causal agent of hydatid disease of man and animals in Australia, and may carry these from the faeces of dogs to food, every effort should be made to trap them and reduce their numbers. Fly traps should be

placed in the vicinity of dog yards, killing pens and stables, which should be kept as clean as possible. Food should always be covered and protected. The daily collection and burning or suitable conservation of faeces in dog yards should lessen the danger of contaminating the dogs' coats and disseminating the eggs.

MACKERRAS (I. M.). **The Seasonal Prevalence of House-flies in Sydney, New South Wales—Preliminary Report.**—*Rep. Direct. Publ. Hlth. N.S.W. 1927*, pp. 205–207, 12 graphs. Sydney, 1929.

Graphs have been constructed for ten centres in the Sydney district to show the weekly variations, from October 1927 to October 1928, in the numbers of house-flies, *Musca domestica*, L. Two ordinary fly-papers having an effective adhesive surface of about 90 sq. ins. each were used at each centre, and for convenience in subsequent transport were fastened, one to the cover and one to the base, on the inside of a strong cardboard box about an inch deep. There were considerable variations in the weekly totals both in the same centre and between the different centres, which was probably due partly to the limited accuracy of the method and partly to actual local fluctuations in the number of flies caused by local environmental changes. The highest total caught in a centre during the year was 9,611 and the lowest 597. Another graph shows the weekly variations in the total from all centres and includes a curve based on the average for each month. Records of *Fannia canicularis*, L., the numbers of which were always scanty except in the autumn and spring, were also kept. A list is given of other insects that were found fairly frequently on the traps.

THEILER (Sir A.). **Investigations into the Problems of Animal Health in Australia.**—*Pamph. Council Sci. Ind. Res. Australia*, no. 10, pp. 9–64. Melbourne, 1929.

In this report the author mentions the principal Arthropods that infest or transmit diseases of domestic animals in Australia, reference being made to the work already done and suggestions given with regard to the lines on which future research should be carried out.

HERMS (W. B.). **The Experimental Method as applied to Entomological Investigations.**—*J. Econ. Ent.*, xxii, no. 1, pp. 45–61, 19 refs. Geneva, N.Y., February 1929.

Experiments cited to illustrate the use of the experimental method of investigation as applied to economic entomology include studies on insect nutrition, hydrogen-ion concentration, and the transmission by insects of human diseases.

MENSE (C.) and others. **Handbuch der Tropenkrankheiten.**—3rd edn., vol. v, part 1, Imp. 8vo, xii+846 pp., 6 pls., 362 figs., numerous bibliographies. Leipzig, J. A. Barth, 1929. Price, paper *M.* 90, bound *M.* 94.

This part, which has been brought fully up to date, includes chapters on filariasis, relapsing fever, Chagas' disease and yellow fever, with notes on their Arthropod vectors and on the measures against them.

HIRST (L. F.). **Transmission of Plague by** *X. cheopis.*—*Brit. Med. J.*, no. 3565, pp. 827–828, 3 refs. London, 4th May 1929.

As it has been suggested that it has not yet been definitely proved that *Xenopsylla astia*, Roths., is not of importance in relation to plague in India, the author discusses arguments given in his previous papers [*R.A.E.*, B, xv, 221 ; xvi, 53], with special reference to Indian conditions as compared with those in Ceylon, where the problem is much less complex. He gives reasons for considering that the seasonal incidence of plague in the United Provinces is more closely correlated with the occurrence of *X. cheopis*, Roths., than with that of *X. astia*. Climate and other factors in India, however, render very difficult the estimation of the relative importance of the various species of rat-fleas in relation to the disease.

HASSELTINE (H. E.). **Rat-flea Survey of the Port of Norfolk, Va.**—*Publ. Hlth. Rep.*, xliv, no. 11, pp. 579–589, 1 pl., 1 chart, 7 refs. Washington, D.C., 15th March 1929.

This report deals with one of a series of surveys of the rat-fleas of ports that are being carried out by the United States Public Health Service [*R.A.E.*, B, xiv, 3 ; xvi, 163 ; xvii, 26], to ascertain at what places there is a danger of the spread of bubonic plague, should the disease be introduced. The survey in Norfolk, Virginia, was carried out from March 1927 to March 1928. Rats were trapped in all parts of the city and taken alive to the laboratory, where they were chloroformed singly in a box, the construction of which is described. The average number of traps in use each day was 53.

The total number of rats caught was 1,561 ; four of these were *Mus* (*Rattus*) *rattus*, and the remainder *M.* (*R.*) *norvegicus*. Of these rats, 883 harboured fleas, the total number of fleas being 4,898, of which 3,999 were *Xenopsylla cheopis*, Roths., 864 *Ceratophyllus fasciatus*, Bosc, 28 *Ctenocephalus canis*, Curt., or *C. felis*, Bch., 6 *Leptopsylla segnis*, Schönh. (*musculi*, Dug.) and 1 *Echidnophaga gallinacea*, Westw. A graph indicating the meteorological conditions during the period of the survey and the average numbers of *X. cheopis* and *C. fasciatus* per rat in each month shows that the *X. cheopis* index follows fairly closely the curves representing relative humidity and mean temperature. *X. cheopis* was the predominant flea from June to January, and *C. fasciatus* from February to May. The *X. cheopis* index of Norfolk (2·56), where there has never been an outbreak of plague, is higher than the indices of New York and Boston, where there have never been outbreaks, but lower than those of New Orleans and San Juan, Porto Rico, where outbreaks have occurred. In view of the numbers of rats and *X. cheopis* in Norfolk from June to November, it must be assumed that plague would spread if introduced, although it is possible that the extremely marked reduction of *X. cheopis* in the winter has been a factor in preventing its appearance [*cf. R.A.E.*, B, xi, 159].

NECHELES (H.). **Observations on the Causes of Night Activity in some Insects.**—*Chinese J. Physiol.*, i, no. 2, pp. 143–156, 1927. (Abstract in *Expt. Sta. Rec.*, lx, no. 3, pp. 247–248. Washington, D.C., February 1929.)

Investigations have shown that neither full sunlight nor light of different wave lengths exerts any direct influence on the activity of

Periplaneta americana, L., *Blatta* (*P.*) *orientalis*, L., or *Anopheles maculipennis*, Mg. Neither sunlight nor arc light produces in the air any gas that exerts a depressing influence on *B. orientalis*, and nitrous oxide has no effect. The only factor that has any appreciable effect on the activity of these insects is the humidity of the atmosphere (as influenced by temperature) and its effect on the rate at which water is lost by them. The hiding of insects during the day is attributed to the necessity for shelter from the excessive evaporating power of day air (low humidity and high temperature) and their activity at night to the reversal of air conditions.

HOWARD (L. O.). **Mosquito Work throughout the World during 1927.** —*Proc. 15th Ann. Mtg. New Jersey Mosquito Exterm. Ass., Atlantic City, 1928*, pp. 6–24. New Brunswick, N.J. [1928.]

This review of investigations on mosquitos and their control, the results of which were in most cases published in 1927, is on the lines of those for previous years. In connection with the unsatisfactory results obtained with stoxal against the larvae of Anophelines and Culicines in the United States by Barber and Komp [*R.A.E.*, B, xvi, 63] and by King and Bradley, the author states that Roubaud is of the opinion that the quantities of the larvicide used were too great, and that the larvae were disturbed. Great care should be taken not to disturb the larvae when applying larvicidal powders, either by agitating the water or by remaining near it, and the stoxal should be blown on to the surface so sparsely that its presence is scarcely discernible [*cf.* B, xvi, 172].

PETERSON (J. P.). **Mechanical Oiling Equipment utilized in New Jersey Mosquito Work and its further Possibilities.**—*Proc. 15th Ann. Mtg. New Jersey Mosquito Exterm. Ass., Atlantic City, 1928*, pp. 45–53, 1 pl. New Brunswick, N.J. [1928.]

A simple method of oiling marshes from barrels carried on a drag drawn by a tractor is described. In upland areas in the county in which this method was employed, a high-compression tank carried on a 1-ton motor truck is used. The oil is discharged from this tank by means of compressed air through a Bordeaux nozzle, a pressure of 30 lb. to the square inch, which enables the spray to be carried 25–30 ft., being found most convenient.

In the discussion that followed, the author gave details concerning the use of crank-case oil. This oil is collected, partly cleaned and stored in tanks holding 4,500 U.S. gallons, at a cost of about 1½*d.* a gallon. In cold weather it has to be thinned before application, but in warm weather this may not be necessary. Crank-case oil has been found to produce a film that lasts 6–8 days longer than that produced by the fuel oil usually employed.

L. L. Williams jr. stated that crank-case oil alone is not an efficient mosquito larvicide under normal summer conditions, being more or less inert. It was found by the United States Public Health Service to be very useful for mixing with kerosene, at the rate of 4 parts oil to 1 part kerosene. The best way of dealing with crank-case oil is to collect it in winter and allow it to settle, and then to run off the thick sediment.

Ginsburg (J. M.). **Studies of Mosquito Oils and Dust Larvicides.**—*Proc. 15th Ann. Mtg. New Jersey Mosquito Exterm. Ass., Atlantic City, 1928*, pp. 53–65, 3 refs. New Brunswick, N.J. [1928.]

In an investigation of three cheap distillate fuel oils commonly used against mosquito larvae in New Jersey, each killed all larvae and pupae if the water surface was thoroughly oiled, but none produced a film that lasted more than about 4 days in hot weather. A much heavier application of oil is consequently needed in the summer, when evaporation and bio-chemical activities, especially in sewage-polluted waters, are high, than in the spring or autumn, when a good oil film may be maintained for 8–15 days.

Several new types of oil were tested against mosquito larvae and pupae, including crude petroleum oils, tar residue oils and petroleum distillate oils. The most efficient of these was a light crude oil (semi-paraffin base), having specific gravity 33° Bé. ; such an oil can be easily sprayed, spreads well, kills larvae and pupae more rapidly than fuel oil, and produces a film that lasts 8–12 days, but it has the disadvantages that it is readily inflammable, irritates the skin, and may vary in composition. A mixture of 50 per cent. tar residue oil with 50 per cent. light crude oil or with 45 per cent. distillate fuel oil and 5 per cent. unsaturated hydrocarbons produced a uniform film that lasted 9–12 days ; these mixtures, however, had the disadvantages that they discoloured the treated areas, stained clothing and containers, and attacked rubber boots and hose pipes. Several petroleum distillate oils were also tested, and two of these, the specifications of which are given, were found to give good results ; both killed larvae in 40–90 minutes, formed films that lasted well, spread well on clear water, but less well on water covered with vegetation or organic matter, and were more pleasant to handle than the darker fuel oils. The spreading power of these two oils was greatly improved by the addition of small quantities of coal-tar acid or hydrocarbons containing unsaturated groups. The amount of coal-tar acid required ranged from 0·5 per cent. for one containing 95 per cent. cresylic acid to 3 per cent. for one containing 15 per cent. cresylic acid ; the tar acids containing the lower concentrations of cresylic acid caused the oil to spread more slowly, but produced a more stable film. The approximate specifications that an oil should possess to be an efficient mosquito larvicide are given.

In two tests with stoxal in mosquito breeding-places, one in salt-marshes and the other in a woodland swamp, unsatisfactory results were obtained ; on the salt-marsh pools, a mixture of stoxal and sand (1 : 20) was spread until the entire surface was covered, using about 25 lb. stoxal to the acre.

Preliminary tests with a new dust consisting of kaolin saturated with about 20 per cent. fuel oil and 6 per cent. high boiling point, unsaturated, hydrocarbons gave very promising results, all larvae and pupae of *Aëdes sollicitans*, Wlk., being killed within 24 hours by an application of this dust at the rate of 100 lb. to the acre. In the discussion that followed, the author stated that the oil is liberated from the kaolin and that the latter sinks to the bottom of the water, carrying with it a part of the high boiling point hydrocarbon, which is very toxic to mosquito larvae. The possible toxicity of the material to fish and domestic animals requires further investigation.

With reference to the use of crank-case oil in mosquito control, the author stated, in answer to a question, that the minimum quantity of

kerosene needed to make this oil spread was about 30 per cent., but that spreading could be obtained by the addition of 5 per cent. neutral hydrocarbons or 3 per cent. hydrocarbons containing 15–25 per cent. cresylic acid.

JACKSON (L. E.). **Mosquito-control Activities of the American Public Health Association.**—*Proc. 15th Ann. Mtg. New Jersey Mosquito Exterm. Ass., Atlantic City, 1928*, pp. 115–122. New Brunswick, N.J. [1928.]

This paper is a summary of a report by the Committee on Mosquito Control of the American Public Health Association, and gives a brief review of the mosquito problems and the organisation of mosquito control throughout the United States.

HEADLEE (T. J.). **Report of the Secretary.**—*Proc. 15th Ann. Mtg. New Jersey Mosquito Exterm. Ass., Atlantic City, 1928*, pp. 126–130. New Brunswick, N.J. [1928.]

Notes are given on various investigations that are reported on more fully elsewhere. In connection with the recommendations for the use of cresylic acid as a spreader for oils [*R.A.E.*, B, xvi, 51], which were based on experiments carried out in the late summer and autumn, it is stated that in August 1927 cresylic acid caused the oil to spread in such a thin film that it was not efficient either in killing the larvae or in lasting.

GIBSON (A.). **Mosquito Suppression in Canada in 1927.**—*Proc. 15th Ann. Mtg. New Jersey Mosquito Exterm. Ass., Atlantic City, 1928*, pp. 136–146, 1 pl. New Brunswick, N.J. [1928.]

The first part of this paper contains a brief account of the mosquito investigations carried out in the various provinces of Canada in 1927; most of the information concerning the western provinces has already been noticed [*R.A.E.*, B, xvii, 34]. In Saskatchewan it was found that the adults, particularly the gravid females, of nearly all the prairie species of *Aëdes* are attracted to fields of lucerne, sweet clover and tall grass, where they obtain shelter from high winds and a more humid environment. This would result in a concentration of eggs in irrigated lucerne and hay fields. A successful campaign against mosquitos was conducted in the Ottawa district, where the commonest species are *Aëdes vexans*, Mg., and *A. simulans*, Wlk. The principal breeding areas, which had been determined by surveys made in previous years, were oiled between 28th April and 7th June, 7,500 gallons of oil being used. A plague of mosquitos at Hawkesbury, Ontario, was found to be due to breeding of *Culex pipiens*, L., in backwaters of the Ottawa River that had become polluted by the accumulation of sulphite pulp waste from a paper mill. The pollution had resulted in the death of the fish in these backwaters.

The addition of crude cresylic acid to oil at the rate of about 1 part to 100 increased the spreading power of the oil and rendered it more rapidly toxic to mosquito larvae. Crude cresylic acid, however, is very caustic to the human skin. For this reason, a 25 per cent. tar-acid oil, which is not harmful to the skin, was used in place of cresylic acid,

under both laboratory and field conditions ; this resulted in the production of a film as good as that produced by cresylic acid. Laboratory experiments with waste sulphite liquor against *Aëdes* spp. showed that at strengths of 5–10 per cent. most larvae and pupae were destroyed, and the adults produced by the remainder were killed by the sulphur dioxide fumes evolved before they could take flight. Similar results were obtained with sulphate liquor, which is, however, a valuable product and not likely to be available for use against mosquitos. W. Rudolfs stated that he experimented with sulphite liquor, and found that when it was applied to either fresh or salt water, so much hydrogen sulphide was produced that he abandoned the experiments.

Under laboratory conditions, powdered derris root dusted on the surface of water, at the rate of 15 lb. to the acre, killed larvae of *Aëdes* in 3–22 hours and pupae in 2–5 days. Under field conditions, derris at the rate of 30 lb. to the acre killed 97 per cent. of the larvae of *Culex pipiens* in 48 hours and 100 per cent. in 72 hours. In the discussion, it was pointed out that in many cases the use of derris would be objectionable on account of its toxicity to fish.

Laboratory tests were made with pyrethrum powder, at rates ranging from 4½ to 35 lb. to the acre, against larvae and pupae of *Aëdes*. A dosage of 9 lb. to the acre appeared to be as effective as one of 35 lb., most of the larvae and pupae dying within 6 hours, all the larvae within 16 hours, and all the pupae within 5 days. At 4½ lb. to the acre, 81 per cent. of the larvae and 57 per cent. of the pupae died within 24 hours, and all within 4 days. The cost for material of 4½ lb. pyrethrum is about the same as the cost of oil for 1 acre at the rate of 1 oz. to 15 sq. ft., *viz.*, about 11 shillings.

HEADLEE (T. J.). **The Development of mechanical Apparatus for detecting the Presence of Mosquitoes in various Localities.**— *Proc. 15th Ann. Mtg. New Jersey Mosquito Exterm. Ass., Atlantic City, 1928*, pp. 160–168. New Brunswick, N.J. [1928.]

The importance of accurate sampling of the adult mosquito fauna of a locality, both for determining the species present and for testing the efficiency of control measures, has long been realised, and the inevitable variations that occur when the mosquitos are caught by hand make it very desirable to devise a method that will eliminate the human factor. The author therefore made studies of traps for mosquitos.

Several types of light-traps were tested, the most efficient being made from a tin 12 inches high and 10–12 inches in diameter. The bottom of the tin was taken out, and a large cone of screen wire, with an opening at the summit not exceeding ¼ inch in diameter, was firmly fastened to the lower edges. A small 2 candle-power carbon filament electric lamp was fixed to the under side of the lid of the tin. The lamps in the traps were in most cases connected with an electric circuit, but as this might not always be available, an adaptation was made that enabled a small dry battery, capable of giving 72 hours' light, to be fixed to the trap.

These traps are hung 4–5 feet from the ground, so that they throw a column of light downwards that attracts the mosquitos. A powerful light did not attract mosquitos, and no mosquitos were caught when the traps were not lighted. The traps were tested at the edge of a wood, where there was a considerable number of mosquitos ; they were placed in position in the late afternoon or early evening, and the catch was

examined next morning. The mosquitos contained in the traps were killed by placing pure calcium cyanide powder on a metal plate that closed the open bottom of the trap.

A table shows the numbers of mosquitos (*Aëdes* spp. and *Culex pipiens*, L.) captured in several types of traps in the autumn of 1927. The catch in a single night in one trap of the type described above is comparable with the catch of one man in 15 minutes. Both sexes are attracted to the traps.

[**Mosquito Control Work and Methods.**]—*Proc. 15th Ann. Mtg. New Jersey Mosquito Exterm. Ass., Atlantic City, 1928*, pp. 24–44, 66–114 & 146–159, 10 pls., 2 figs. New Brunswick, N.J. [1928.]

Reports on local mosquito control work in several States in 1927 are given. In New Jersey, the summer, like that of 1926, was abnormally wet ; from the middle of July until October conditions were so favourable for mosquito breeding that all available resources had to be strained to the utmost to deal with the problem. Although mosquitos were troublesome at times in the areas in which control measures were carried out, they were negligible in comparison with the numbers that occurred in unprotected areas.

Other papers included are : A History of Salt-marsh Ditch-cutting and Ditch-cleaning Machinery, by F. A. Reiley; Contribution to the Causes of Mosquito Breeding in specific Places, by W. Rudolfs ; The Effect of *Chara fragilis* on Mosquito Development, with a Note on a new Larvicide, by R. Matheson ; and Some Phases of the Salt-marsh Mosquito Problem in the South Atlantic and Gulf States, by T. H. D. Griffitts. The information contained in the last three papers has been noticed elsewhere [*R.A.E.*, B, xvi, 141, 142 ; xvii, 68, 86]. In reply to a question on his paper, Matheson said that he believed that when water in a pool treated with borax evaporated, the borax remained in the form of crystals on the surface of the soil, and did not readily pass into it ; consequently the effect of the treatment should last for a number of years. Matheson also stated that he had found a newt, *Diemictylus viridescens*, to be very destructive to mosquito larvae in pools in New York State ; in an aquarium, one of these newts would eat 60 or 70 mosquito larvae in an hour. In reply to a question arising out of another paper, J. M. Ginsburg stated that in some woodland pools that were treated in the late autumn, after the period of egg-laying, with oil containing about 15 per cent. cresylic acid, no mosquito larvae were found in the spring until three weeks after they had appeared in surrounding pools that had not been treated ; it thus appeared probable that the autumn treatment destroyed the eggs.

Twinn (C. R.) & Ryan (W. St. G.). **The Household Mosquito, *Culex pipiens* Linn., and its Control at Montreal.**—*19th Rep. Quebec Soc. Prot. Plants 1926–27*, pp. 12–16, 3 figs., 5 refs. Quebec, 1927.

This is an account of the bionomics and control of *Culex pipiens*, L., in the district of Montreal, where, owing to the existence of a particularly favourable breeding-ground in the form of an extensive swamp highly polluted by sewage, it becomes exceedingly abundant during the summer and readily attacks man, particularly at night. Oiling,

from mid-July to early August, resulted in material reduction of its numbers. Permanent control could be effected by preventing the contamination of the swamp so that fish would then be able to live there.

CHOWDHURY (K. L.). **A new Variety of Protanopheline, *A. barbirostris* Van der Wulp, var. *ahomi*, found in Upper Assam.**—*Ind. J. Med. Res.*, xvi, no. 4, pp. 986–988, 1 fig., 3 refs. Calcutta, April 1929.

Anopheles barbirostris var. *ahomi*, n., is described on larval characters from Assam and compared with the larvae of *A. barbirostris*, Wulp, and *A. barbumbrosus*, Strickl. & Chdy. (*barbirostris* var. *pallidus*, Swell.).

KORKE (V. T.). **Observations on the Atypical Variety of *bancrofti* and its Significance.**—*Ind. J. Med. Res.*, xvi, no. 4, pp. 1023–1031, 1 pl., 6 refs. Calcutta, April 1929.

The typical and atypical forms of *Filaria bancrofti* found in man in Bihar and Orissa (*R.A.E.*, B, xvii, 114) and the correlation of the atypical form with the prevalence of elephantiasis of the extremities are discussed. The atypical forms are found in large numbers in the Soro area where *Taeniorhynchus annuliferus*, Theo., *T. uniformis*, Theo., and *Culex vishnui*, Theo., are recorded, and in the Jellaswar area where *T. uniformis*, *Lutzia fuscana*, Wied., *Culex fatigans*, Wied., *C. vishnui*, *C. bitaeniorhynchus*, Giles, *C. epidesmus*, Theo., and *C. whitmorei*, Giles, occur.

WEBSTER (W. J.). **A Note on the Anophelines found in Baroda Camp.**—*Ind. Med. Gaz.*, lxiv, no. 4, pp. 197–198, 4 refs. Calcutta, April 1929.

In the course of a year in camp at Baroda the following Anophelines were observed: *Anopheles subpictus*, Grassi (which was by far the commonest), *A. culicifacies*, Giles, *A. stephensi*, List., *A. fuliginosus*, Giles, *A. theobaldi*, Giles, *A. jeyporiensis*, James, *A. funestus*, Giles (of which *A. listoni*, List., is treated as a synonym), and *A. maculipalpis*, Giles. Brief notes on the habitats of the adults and sometimes the larvae are given, most of the species having been occasionally observed in houses.

LABERNADIE (V.). **Note sur le paludisme à Pondichéry.**—*Rev. Méd. Hyg. trop.*, xxi, no. 1, pp. 19–21. Paris, 1929.

The author points out that malaria is rare among both Europeans and natives in Pondicherry, in spite of the fact that few people take quinine or use mosquito nets. The town is surrounded by rice-fields, but is fairly extensive and lacking in suitable breeding-places for Anophelines, which can, therefore, only come from outside. Cattle are numerous in this district, even within the town, one or more of these animals being found in each house, and the few Anophelines that do not remain associated with cattle outside the town are attracted by those within. Of the mosquitos captured in the town and neighbouring villages, only 6 per cent. were Anophelines, the species being *Anopheles* (*Pseudomyzomyia*) *vagus*, Dön., and *A.* (*Neomyzomyia*) *tessellatus*, Theo., and none of these was caught in the town itself. Zootropism was particularly evident in one village, where all the female Anophelines

were caught in stables. The splenic index among school children was less than 1 per cent., and even those showing enlarged spleens were from the villages and not from the town.

MacArthur (W. P.). **The Adult Mosquitoes of Shanghai.**—*J. Roy. Army Med. Corps*, lii, no. 4, pp. 241–247, 4 refs. London, April 1929.

This paper deals with 11 species of mosquitos collected in Shanghai during the summer of 1927, some characters for their identification being given. Following the occurrence of 352 cases of primary malaria due to *Plasmodium vivax* among British troops temporarily resident in this district, which was believed to be free from the disease, a hasty survey resulted in the detection of 200 cases of probable malaria among the natives examined. The numerous Anophelines captured were all *Anopheles hyrcanus*, Pall., which was much commoner in tents than in houses. Experiments showed that this species could easily be infected with *P. vivax*. The apparent immunity of the European population would seem to be due to the habits of *A. hyrcanus*, which, finding an ample food supply elsewhere, does not enter large, airy houses.

The Culicines discussed include *Armigeres obturbans*, Wlk., and *Aëdes albopictus*, Skuse, both of which are probable carriers of dengue; *A. chemulpoensis*, Yamada, which is suspected of being a vector of *Filaria bancrofti*; and *Culex pipiens*, L., and *C. fatigans*, Wied., the distinction between which in eastern Asia is less clear than in other parts of their range. *Aëdes argenteus*, Poir., could not be found by the author either in Shanghai or in Hong Kong, even during an outbreak of dengue at the latter place.

Duren (A. N.). **Contribution à l'étude des culicides du Congo belge, Province du Congo-Kasaï.**—*Ann. Soc. belge Méd. trop.*, ix, no. 1, pp. 97–115, 8 refs. Brussels, 31st March 1929.

The author points out the importance of taking into consideration the adults captured in and around houses and the number of females engorged with blood as well as the results of larval rearings, if a true estimate of the domestic mosquito fauna of a district is to be obtained. Notes are therefore given on the adult mosquitos captured at Leopoldville in the Belgian Congo, as well as on the larvae and their breeding-places. Lists of mosquitos taken in other localities are also given.

Riqueau (—). **Les trous de crabes, gîtes à larves.**—*Bull. Soc. Path. exot.*, xxii, no. 3, pp. 175–179, 1 fig. Paris, 1929.

A case is recorded of *Aëdes argenteus*, Poir. (*Stegomyia fasciata*, F.) persisting in a district on the outskirts of Dakar where every precaution had been taken to control it. Eventually the larvae were found in crab-holes in water-pockets several feet below the level of the ground.

Basile (C.). **Studi di biologia nelle infezione ad ospite trasmissore per medici e laureandi in medicina.** [Biological Studies on Insect-borne Diseases for Doctors and Graduates in Medicine.]—*Arch. ital. Sci. med. colon.*, viii, nos. 2, 3, 5, 6, pp. 55–58, 123–125, 235–245, 299–304, 12 figs., 1 pl., 34 refs. Tripoli, 1927.

The methods of transmission of plague, malaria, and diseases caused by *Leishmania* spp. are discussed and compared.

Franchini (G.). **Brevi note di malariologia in provincia di Bologna.**
Bonura (P.). **Distribuzione della malaria in provincia di Bologna quali le specie di *Anopheles* riscontrate nelle zone malarigene.** [The Distribution of Malaria in the Province of Bologna and of the Species of *Anopheles* found in the Malarious Localities.]—*Arch. ital. Sci. med. colon.*, viii, no. 5, pp. 246–252 ; ix, no. 2, pp. 84–95, 2 maps. Tripoli, 1927 & 1928.

Malaria has decreased considerably in the province of Bologna during the past ten years, but a few endemic foci remain in two communes. The cases, however, are few in number and are due to *Plasmodium vivax*. In the more important foci, *Anopheles maculipennis*, Mg. (*claviger*, auct.) was the only Anopheline found or was predominant. *A. hyrcanus* var. *pseudopictus*, Grassi, only occurred in any abundance where malaria was rare, and was more numerous where the disease was absent. Cattle were not more numerous in the infected localities.

Patané (C.). **Sulla distribuzione di *Stegomyia fasciata* in Cirenaica. Sua frequenza ed abitudini biologiche in Bengasi nelle diverse stagioni.** [On the Distribution of *Aëdes argenteus* in Cyrenaica. Its Incidence and Bionomics at Bengasi.]—*Arch. ital. Sci. med. colon.*, viii, no. 5, pp. 262–270, 1 map. Tripoli, 1927.

Observations on *Aëdes argenteus*, Poir. (*Stegomyia fasciata*, F.) were carried out in Cyrenaica from 1915 to 1925. It seems to occur in nearly all inhabited localities on the coast, but was not found in the high plateau. It feeds at temperatures of 20° C. [68° F.] or over, which occur on the coast from March to November, but does not attack man so frequently as other domestic Culicines do. In winter the adults are rare and are found only in sheltered places ; they do not feed readily and only bite at mid-day. *A. argenteus* does not seem to be able to hibernate at Bengasi in the larval stage. The adults begin to increase in numbers in June, and feed voraciously throughout the summer and autumn from early morning to late evening, and even at night in well-lighted rooms. Their numbers increase steadily from June to September, but they are not easy to find in dwellings, and remain less common than other Culicines. Sometimes a great increase in their numbers results from torrential rain in September, but even so they do not represent more than 20–25 per cent. of the mosquitos captured.

Franchini (G.). **III Nota di entomologia sulle Colonie italiane.** [Third entomological Note on the Italian Colonies.]—*Arch. ital. Sci. med. colon.*, viii, no. 7, pp. 363–366, 5 refs. Tripoli, 1927.

This annotated list of Diptera and ticks of possible medical and veterinary importance includes several species mentioned in subsequent papers of this series. *Anopheles hyrcanus* var. *pseudopictus*, Grassi, is recorded for the first time from Cyrenaica, where cases of indigenous malaria have not, however, apparently been observed. Other Diptera recorded from this colony include *Culicoides pulicaris*, L., *C. pictipennis*, Winn., *Tabanus agricola*, Wied., *Lucilia sericata*, Mg., *Musca sorbens*, Wied. (*humilis*, Wied.), and *Cephalopsis titillator*, Clark. All the mosquitos from the oasis of Ghadames in Tripoli were *Theobaldia longiareolata*, Macq. (*spathipalpis*, Rond.). Those from the oasis of Tauorga, the sole locality in Tripoli where malaria is severe, are noticed below [*R.A.E.*, B, xvii, 144].

LODATO (G.). **L'uso del latte acido indigeno quale causa di miasi intestinale a Gadàmes.** [The Use of native sour Milk as a Cause of intestinal Myiasis at Ghadames.]—*Arch. ital. Sci. med. colon.*, viii, no. 7, pp. 393–395. Tripoli, 1927.

The larvae of *Lucilia caesar*, L., found in sour milk, are responsible for intestinal myiasis in the oasis of Ghadames in western Libya.

FRANCHINI (G.). **Ixodidi delle Colonie italiane dell'Africa del nord e dell'Africa orientale.** [Ticks of the Italian Colonies of North and East Africa.]—*Arch. ital. Sci. med. colon.*, viii, no. 10, pp. 555–558. Tripoli, 1927.

Ticks from Cyrenaica additional to those already recorded [*R.A.E.*, B, xi, 60 ; xiv, 184] are *Hyalomma aegyptium dromedarii*, Koch, *H. mauritanicum*, Sen., *Boophilus* (*Rhipicephalus*) *annulatus*, Say, and *Ornithodorus savignyi*, Aud. Nearly all the species from Cyrenaica occur in Tripoli, as does also *Ornithodorus* sp., probably *O. lahorensis*, Neum. In Eritrea are recorded *Rhipicephalus sanguineus*, Latr., *Ixodes ricinus*, L., *Argas persicus*, Oken, *O. moubata*, Murr., and *O. savignyi*. Besides the species already recorded from Italian Somaliland [B, iv, 70 ; xiv, 184], *Haemaphysalis cinnabarina punctata*, C. & F., *Amblyomma gemma*, Dön., and *Hyalomma lusitanicum*, Koch, have been observed in Jubaland.

VENERONI (C.). **Le paralisi da zecche in Somalia.** [Tick Paralysis in Somaliland.]—*Arch. ital. Sci. med. colon.*, ix, no. 7, pp. 405–406. Tripoli, 1928.

A brief description is given of two cases of temporary paralysis in young children in Italian Somaliland, thought to be due to the tick, *Rhipicephalus simus*, Koch, which is always found in native huts.

FRANCHINI (G.). **Su di alcune specie di zanzare non ancora descritte nelle nostre colonie.** [Some Species of Mosquitos not previously recorded from Italian Colonies.]—*Arch. ital. Sci. med. colon.*, ix, no. 8, pp. 458–459. Tripoli, 1928.

The mosquitos recorded include *Anopheles mauritianus*, Grp., and *A. algeriensis*, Theo., which are associated with malaria in the oasis of Tauorga, and *Aëdes argenteus*, Poir., in Tripoli ; *Anopheles mauritianus* and *Aëdes argenteus* in Eritrea ; and *Aëdes albicosta*, Edw., of which the hitherto unknown male was observed, in Italian Somaliland.

PAMPANA (E. J.). **La medicina tropicale nella Columbia occidentale.** [Tropical Medicine in the West of Colombia.]—*Arch. ital. Sci. med. colon.*, ix, no. 8, pp. 460–480, 1 fig., 18 refs. Tripoli, 1928.

The region of Colombia, in which these observations were made and which has the extraordinary rainfall of about 300 inches, is highly malarious. All three forms of the disease occur, malignant tertian being the most common. Dry periods of even a few days are rare, but they are always followed by an increase in malaria, as they enable mosquito larvae to develop in numbers and the adults to be active, whereas the customary torrential rain sweeps away the majority of the

larvae and restricts the flight of the adults. The species of *Anopheles* recorded are *A. tarsimaculatus*, Goeldi, *A. albimanus*, Wied., and a third that is not definitely identified and is perhaps negligible from the point of view of malaria, its larva being sylvan. Of the two others, *A. tarsimaculatus* predominates everywhere. They both breed in clear, stagnant, or slow-flowing water. Larvae were never found in water unprotected by vegetation unless it was shaded, but have been taken in puddles in hoof-marks. Drainage and oiling resulted in a considerable diminution of malaria in the mining camps, but its elimination is not feasible because the native villages are a source of infection and the mosquitos have a flight-range of about 2 miles.

The information given on Colombian relapsing fever has been noticed from another source [*R.A.E.*, B, xvi, 111]. Both *Dermatobia hominis*, Say (*cyaniventris*, Macq.) and *Tunga* (*Sarcopsylla*) *penetrans*, L., are rare in the district under consideration, where, however, a species of *Trombicula* is very troublesome. It may be destroyed by a lotion of equal parts of alcohol and benzine.

FRANCHINI (G.). **Nuove osservazioni di entomologia nelle Colonie italiane.** [New entomological Observations in the Italian Colonies.] —*Arch. ital. Sci. med. colon.*, ix, no. 10, pp. 579–580. Tripoli, 1928.

Hyalomma aegyptium, L., is recorded from Tripoli and Eritrea, and *Rhipicephalus sanguineus*, Latr., *Hippobosca capensis*, Olfers, and *H. maculata*, Leach, from Tripoli.

TARANTINO (G. B.). **Tripanosi del dromedario nella Somalia italiana.** [Trypanosomiasis of Camels in Italian Somaliland.]—*Clinica vet.*, lii, no. 2, pp. 77–79. Milan, February 1929.

A brief account is given of the trypanosomiasis of camels in Italian Somaliland. According to the natives, the insects responsible include Tabanids and *Glossina pallidipes*, Aust., which is very common in certain areas.

BRUMPT (E.). **Eclectisme alimentaire des réduvidés vecteurs du *Trypanosoma cruzi*.**—*Pr. méd.*, xxxv, no. 77, pp. 1161–1162, 4 figs. Paris, 24th September 1927. (Abstracts in *Trop. Dis. Bull.*, xxiv, no. 12, p. 974. London, December 1927. *Bull. Inst. Pasteur*, xxvii, no. 7, p. 335. Paris, 15th April 1929.)

The author observed the occurrence of the Reduviid, *Triatoma rubrovaria*, Blanch., in stony tracts in Uruguay where the only vertebrates apparently present were lizards. In captivity, the larvae of this bug fed equally readily on a lizard and a bat. On his return to Paris, the author found that *Triatoma megista*, Burm., *T. infestans*, Kl., and *Rhodnius prolixus*, Stål, would engorge on a grass snake, a lizard, and a freshwater tortoise, even when not starved. *R. prolixus* also fed on a frog. The author points out that the wide range of hosts attacked by these Reduviids, which include species that are known to be vectors of *Trypanosoma cruzi*, would render their destruction very difficult; he also suggests that the reptiles and batrachians on which they feed may be reservoirs of the trypanosome.

FOLEY (H.). **Sur divers arthropodes piqueurs observés au cours de la mission du Hoggar. 2ème note.**—*Bull. Soc. Hist. nat. Afr. N.*, xx, no. 2, pp. 47–54, 2 pls., 2 figs., 17 refs. Algiers, 1929.

These further notes on blood-sucking Arthropods collected in the Algerian Sahara [*R.A.E.*, B, xvii, 82] include a reproduction of the original description of *Ornithodorus foleyi*, Parrot [xvi, 265], and notes on the distribution and hosts of the flea, *Xenopsylla ramesis*, Roths., which was taken on a rodent, *Psammomys algiricus*, and the distribution and habits of the Ceratopogonid, *Holoconops mediterraneus*, Kieff. [*cf.* xii, 110]. This midge occurs in swarms around pools and in palm groves, and causes considerable annoyance to man. A Lygaeid, *Artheneis alutacea*, Fieb., which is normally found on the flowers of *Tamarix aphylla*, is recorded as piercing the skin of man, this being an addition to the list of phytophagous Rhynchota accidentally sucking blood [xiv, 104, 169]. Larvae and nymphs of *Hyalomma aegyptium*, L., were found on *Psammomys algiricus*.

TALICE (R. V.). **Sur le rôle du *Pediculus vestimenti* dans la transmission de la fièvre récurrente espagnole (expérimentation sur l'homme et les animaux).**—*Ann. Parasit. hum. comp.*, vii, no. 3, pp. 177–189, 9 refs. Paris, 1st May 1929.

The following is largely taken from the author's summary :—

A series of experiments are described from which it was hoped to determine the rôle of *Pediculus humanus*, L. (*vestimenti*, Nitz.) in the transmission of *Spirochaeta* (*Treponema*) *hispanica*, the causal organism of Spanish relapsing fever. Among eight persons inoculated with lice fed on infected cases, seven proved negative and one doubtful, and in a further set of experiments the inoculation of five men gave negative results in every case. In tests with animals, 13 mice, seven rats and one monkey all gave negative results.

HORNUS (P.). **Note au sujet de la fièvre récurrente marocaine.**—*Arch. Inst. Pasteur Tunis*, xvii, no. 4, pp. 327–331. Tunis, 1928.

The occurrence of relapsing fever in Morocco has been recognised since 1908. Observation has shown that Europeans are particularly attacked, especially during the summer and autumn. The incidence of the disease has no relation to pig farms, and there is no evidence of infected persons having been bitten by ticks. The transmitting agent, however, apparently occurs in the ground or the walls of dwellings and retains its virulence for a long time. Inoculated into guineapigs, the spirochaete produces symptoms very similar to those in man.

NICOLLE (C.) & ANDERSON (C.). **A propos de l'article : Fièvre à tiques marocaine, du médecin capitaine Chaubet.**—*Arch. Inst. Pasteur Tunis*, xviii, no. 1, pp. 84–85. Tunis, 1929.

The occurrence in Morocco of cases of relapsing fever of a particular type that it does not seem possible to connect with the form carried by lice and that much more closely resembles Spanish relapsing fever, carried by *Ornithodorus marocanus*, Velu, has been recorded [see preceding paper]. Attention has recently been drawn to three cases that were apparently due to ticks.

COLAS-BELCOUR (J.). **Ponte et éclosion des Ornithodores : Leur élevage.**—*Arch. Inst. Pasteur Tunis*, xviii, no. 1, pp. 43–49, 11 refs. Tunis, 1929.

The author discusses methods of rearing strains of ticks from isolated females, as this is necessary in studying their relations to spirochaetes in order to obtain a strain that is definitely free from infection or only harbours one acquired experimentally. The ticks should be fed on a host that is susceptible to the spirochaetes that they transmit, so that infection can be observed if it is present. The larval and nymphal stages resulting from each batch of eggs should be fed on a fresh susceptible host. When an uninfected strain is being obtained, each female tick after oviposition should be crushed separately in a little physiological solution, for inoculating a susceptible host as an additional test of its having been uninfected.

Among the species studied, *Ornithodorus moubata*, Murr., and *O. savignyi*, Aud., are considered to belong to a xerophilous group, in which even the early stages are resistant to desiccation ; another group, to which the North African species, *O. normandi*, Larr., *O. erraticus*, Lucas, and *O. marocanus*, Velu, belong, are distinctly hygrophilous, the eggs at least being very susceptible to desiccation. In the case of *O. savignyi* there are even indications that the presence of sand is the determining factor in oviposition.

NICOLLE (C.), ANDERSON (C.) & MAGID RAHAL. **Contamination simultanée de laboratoire par deux virus récurrents.**—*Arch. Inst. Pasteur Tunis*, xviii, no. 1, pp. 55–62. Tunis, 1929.

A case is recorded of one of the authors becoming infected, through a cut on the hand, simultaneously with *Spirochaeta hispanica* and *S. sogdiana*. The fact that the blood of the infected man conferred on guineapigs a strong immunity against *S. hispanica* from Spain, and not against *S. hispanica* var. *marocana*, proves that these two spirochaetes, although carried by the same tick and causing similar infections in man and guineapigs, are distinct, and perhaps the latter should not be considered as merely a variety of the former.

CATANEI (A.). **Sur un essai de transmission du spirochète des poules par** *Ornithodorus savignyi*.—*C.R. Soc. Biol.*, c, no. 12, pp. 1018–1019, 4 refs. Paris, 19th April 1929.

An experiment is recorded in which nymphs of *Ornithodorus savignyi*, Aud., fed on a fowl infected with *Spirochaeta gallinarum*, failed to transmit the disease to another by biting, thus confirming the recent finding of other investigators [*R.A.E.*, B, xvii, 18].

MOHLER (J. R.). **Texas or Tick Fever.**—*Fmrs. Bull. U.S. Dept. Agric.*, no. 569, revd. edn., 26 pp., 5 figs. Washington, D.C., November 1928.

This bulletin, which gives a general account of Texas fever caused by *Piroplasma bigeminum* and its prevention, and of the ticks found on cattle in the United States and their effects on the animals, is a revision of an earlier one [*R.A.E.*, B, ii, 101]. There is some amplification of the section dealing with the immunisation of susceptible cattle by blood inoculation.

STILES (G. W.). **Investigations on Anaplasmosis in Cattle.**—*J. Amer. Vet. Med. Ass.*, lxxiv, no. 5, pp. 704–723, 3 figs., 17 refs. Detroit, Mich., April 1929.

In the course of this report on anaplasmosis in cattle in the United States the author discusses numerous Arthropods that might possibly be concerned in the transmission of the infection. Anaplasmosis has been experimentally transmitted by ticks, but most investigators report the disease from "tick-free" areas in the United States. If flies and mosquitos are active factors, a more widespread distribution of the disease in individual herds and in herds on adjoining premises would be expected, whereas it is quite common to find an infected herd on one side of a common barbed wire fence and an uninfected herd on the other, or a single infected cow in a group, the other members of which remain healthy although flies and mosquitos are active among the entire herd. The author believes that the range of activity of the vector is limited, and that lice could be a potent factor in the spread of the disease, though evidence shows that lice are more numerous in the winter months when anaplasmosis is least prevalent. Reports indicate that rats are very numerous in the regions where anaplasmosis is found, and it is possible that the mites found on these rodents may be factors in the dissemination of the disease.

HUE (C. H.) & LEE (C. U.). **New Technique for feeding Sandflies (*Phlebotomus*) for experimental Transmission of Kala-azar.**—*Proc. Soc. Exper. Biol. & Med.*, xxvi, no. 4, pp. 277–280. [New York] January 1929. (Abstract in *Bull. Inst. Pasteur*, xxvii, no. 8, p. 382. Paris, 30th April 1929.)

The blood is taken aseptically from the carotid artery of a hamster [*Cricetulus*] heavily infected with kala-azar, and is defibrinated and centrifuged. The spleen is removed from the animal and crushed, and the plasma of the blood is mixed with it; this mixture is then centrifuged, and a sufficient quantity of blood corpuscles is added to the supernatant liquid to produce a mixture of approximately the same concentration as normal blood. A piece of flannel is soaked in this liquid, stretched over an aluminium ring and covered with a piece of shaved, but not sterilised, skin from the back of the hamster. This is then put in an incubator at a temperature of 35° C. [95° F.], and a cage containing sandflies (*Phlebotomus*) bred in the laboratory in the previous 24 hours is placed on the skin. The sandflies pierce the skin and engorge on the flannel, which takes the place of the subcutaneous cellular tissue.

ADLER (S.) & THEODOR (O.). **Attempts to transmit *Leishmania tropica* by Bite: the Transmission of *L. tropica* by *Phlebotomus sergenti*.**—*Ann. Trop. Med. Parasit.*, xxiii, no. 1, pp. 1–16, 1 pl., 7 refs. Liverpool, 26th April 1929.

As *Leishmania tropica* adopts an anterior position in *Phlebotomus papatasii*, Scop., it was concluded that transmission in nature takes place by the bite of the sandfly. Experiments were therefore undertaken, and 253 individuals of *P. papatasii*, heavily infected with *L. tropica* from cultures, were fed on 12 human beings and a dog. Although most of the sandflies bit 2–5 times before completing their feed, the dog and eleven of the volunteers remained negative during an observation period of 1–14 months. In the case of one individual, *L. tropica* developed

on one of the areas on which infected sandflies had fed, but this experiment cannot be regarded as absolutely conclusive, as this volunteer had lived in a quarter of Jerusalem where oriental sore occurred and the possibility of natural infection is not excluded.

In order to determine whether flagellates can leave the sandfly by way of its proboscis, infected individuals were allowed after eight days to feed through a membrane on inactivated defibrinated blood, which was then examined in fresh preparations and in cultures; in two out of eight experiments positive results were obtained.

Other experiments showed that *L. tropica* acquires its flagellate form in *P. sergenti*, Parrot, and undergoes a cycle of development similar to that in *P. papatasii*, tending to an anterior position, and after 6 days at 27° C. [80·6° F.] forms appear that are infective for man, as was shown by inoculation of flagellates from the mid-gut.

ADLER (S.) & THEODOR (O.). **Additional Evidence on the Occurrence of *L. tropica* in wild *Phlebotomus papatasii*.**—*Ann. Trop. Med. Parasit.*, xxiii, no. 1, pp. 19–21, 5 refs. Liverpool, 26th April 1929.

Since it has been implied that positive results recorded in the infection of *Phlebotomus papatasii*, Scop., with *Leishmania tropica* were probably obtained with *Phlebotomus sergenti*, Parrot, wrongly identified as that species, the author points out that in experiments in which *L. tropica* was transmitted to man from artificially bred sandflies [*R.A.E.*, B, xv, 220], the flies were bred in the laboratory and regularly identified by an examination of the pharynx [*loc. cit.*]. Strains of *L. tropica* vary greatly in their infectivity for *P. papatasii*, some producing a high infection rate even when a small number of parasites are ingested and others a slight infection rate when very large numbers of parasites are ingested. Negative results merely prove that some strains of *L. tropica* are completely non-infective for *P. papatasii*.

With regard to Sinton's criticism [xv, 206] that the identification of *P. papatasii* in previous experiments in Palestine, where positive results were obtained with naturally infected sandflies [xiii, 175; xiv, 167], was based on negative evidence, the authors point out that, although there is a very slight possibility that *P. sergenti* occurring in small numbers may have been overlooked, a re-examination of their slides shows a mounted head with a pharynx typical of *P. papatasii* in the case of a sandfly from which oriental sore had been produced. The occurrence of *L. tropica* infective for man in wild *P. papatasii* is, therefore, proved conclusively.

TAYLOR (A. W.). **Note on the Occurrence of Crithidia in *Phlebotomus minutus* var. *africanus* in Northern Nigeria.**—*Ann. Trop. Med. Parasit.*, xxiii, no. 1, pp. 33–35, 1 fig., 3 refs. Liverpool, 26th April 1929.

Dissection of individuals of *Phlebotomus africanus*, Newst., that had been feeding on monitor lizards (*Varanus*) showed that 10·2 per cent. contained in the mid-gut crithidia of the type of those of *Trypanosoma grayi*. Between 1923 and 1928 examination showed that 77 out of 106 of these lizards were infected with *Trypanosoma varani*, and since the blood of several of the lizards from the cage in which *P. africanus*

had been feeding was found to contain trypanosomes, the flagellates were evidently crithidial forms of *T. varani* undergoing incomplete development in the sandfly; it is possible that their occurrence is accidental. The heaviest infections were found in sandflies in which digestion was far advanced (2–3 days after feeding). Sandflies containing fresh blood and those in which digestion was complete were negative.

MACLEAN (G.). **The Relationship between Economic Development and Rhodesian Sleeping Sickness in Tanganyika Territory.**—*Ann. Trop. Med. Parasit.*, xxiii, no. 1, pp. 37–46, 1 map, 1 diagr., 3 refs. Liverpool, 26th April 1929.

In the days before European domination, the forest peoples in Tanganyika Territory were forced by tribal wars to live for protection in large communities. Round these settlements were grazing and arable lands, and the main occupations of the people in the intervals of peace were agriculture and stock-raising. While there were hunters and possibly also honey-collectors and fishermen, the normal life was probably such as reduced the contact between man and tsetse-fly to a minimum. With the establishment of peaceful administration, the disintegration of the large communities began. Slaves that had been depended on to till the land were liberated and returned to their homes. It became possible for a man to take his family into the virgin forest and start a small remote settlement of his own, and the rise of this type of family village in the midst of fly areas has been one of the most important predisposing causes in the epidemiology of Rhodesian sleeping sickness. The demand for labour has also caused many natives to leave their forest homes; and they either settle permanently in more civilised parts of the country or only return to their homes at intervals, so that their labour is largely lost to their chiefdoms, local development is hampered and more land reverts to bush. The protection afforded by the cleared land is thus lost, and at certain times of the year both *Glossina morsitans*, Westw., and *G. swynnertoni*, Aust., are found almost everywhere, occasionally even inside the houses. When this stage is reached, the introduction of trypanosome infection completes the devastation of the villages.

With regard to remedial measures in sleeping sickness areas, it is suggested that the situation can be met by encouraging native agriculture and settling the people in communities by clearing unoccupied land for them on the borders of open country. Where, for various reasons, the people must still live in the forest, the dangerous family village can be eliminated by making settlements in large clearings.

POMEROY (A. W. J.). **Report of the Medical Entomologist.**—*Rep. Med. & Sanit. Dept. Gold Coast 1927–28*, p. 57. Accra [1929].

In a tsetse-fly survey of the northern portion of a cattle route in the Northern Territories of the Gold Coast, *Glossina palpalis*, R.-D., *G. tachinoides*, Westw., and *G. morsitans submorsitans*, Newst., were found at river crossings. No flies were found at one locality on a tributary of the Volta, although they were abundant 12–16 miles away on the banks of the latter; this appeared to be due to the clearing of the vegetation at this point, and shows the value of such measures.

Pearce (E. K.). **Typical Flies : A Photographic Atlas of Diptera. Series iii.**—Super Roy. 8vo, xv+64 pp., 162 figs. Cambridge, The Univ. Press, 1928. Price 10*s.* net.

This is the third volume of this series, and besides the preface and Brauer's classification, reprinted from the earlier volumes [*R.A.E.*, B, ix, 196], contains a further 162 figures of British Diptera, including six species of Tabanids, with notes on each and a list of books and papers recommended for students' use.

de Nooy (J. A.) & Wolff (J. S.). **Ophoogen van moerassige Terreinen met Stadsvuilnis.** [The Filling up of Marshlands with Town Refuse.]—*Geneesk. Tijdschr. Ned.-Ind.*, lxix, no. 2, pp. 149–155, 2 pls. Weltevreden, 20th February 1929. (With a Summary in English.)

A marsh at Semarang (Java), covering about 200 acres, produces *Anopheles ludlowi*, Theo., in large numbers at certain periods of the year, and ordinary methods being impracticable, the work of filling it up with town refuse was begun early in June 1926. It proved impossible to continue it, however, until steps were taken to prevent the breeding of flies in the refuse. The rubbish is dumped in layers about 9 ft. thick, each day's deposit is immediately covered with a layer of earth about 2–3 inches deep, and after 4–5 days combustible material is spread over the earth and set alight. The earth prevents the underlying mass from burning and the heat kills the larvae and pupae with which the layer of earth is sometimes swarming. Adult flies on the parts filled up are caught on pieces of hoop-iron or cane smeared with axle-grease and hung up in small bamboo huts in which the flies seek shelter from sun and rain.

MacDougall (R. S.). **Insect Pests, No. IV. Acarina injurious to Stock.**—*Scot. J. Agric.*, xii, no. 2, pp. 155–164, 3 figs. Edinburgh, April 1929.

Brief accounts are given of mites and ticks attacking domestic animals and poultry, excluding Sarcoptids, which were dealt with in a previous paper [*R.A.E.*, B, xvi, 229]; these include a record of *Linguatula lanceolata* from the nostril of a dog.

Warburton (C.). **Annual Report for 1928 of the Zoologist.**—*J. R. Agric. Soc. England*, lxxxix, pp. 316–322. London, 1928.

The various parasites of domestic animals about which enquiries were made during the year are mentioned. It is pointed out that since the larvae of warble-flies (*Hypoderma*) enter the hide of the backs of cattle from the inside it is useless to smear the backs of the animals to keep off the fly. Experiments are being made with a proprietary ointment from Denmark to kill the larvae in the warbles, but although the results are sufficiently encouraging to warrant their repetition, definite recommendations cannot yet be made.

Davies (W. M.). **Hibernation of *Lucilia sericata*, Mg.**—*Nature*, cxxiii, no. 3107, pp. 759–760. London, 18th May 1929.

In observations on *Lucilia sericata*, Mg., which is the only species of blow-fly attacking sheep in North Wales, larvae received from 5th

May until 8th September gave rise to adults in an average period of 21 days, but the majority of larvae received on 8th and 10th September had not pupated by 10th October, and not a single larva of 10 subsequent batches, which were received up to 27th October, pupated. These larvae were used in a number of experiments, which are described, and the results show that in North Wales the normal mode of hibernation is in the larval stage. The return of the larvae to within approximately $\frac{1}{4}$ inch of the surface of the soil prior to pupation obviously facilitates emergence. It is pointed out that they are more susceptible to control measures at this period than at any stage after leaving their host.

Papers noticed by Title only.

Paillot (A.). **La symbiose bactérienne et l'immunité humorale chez les Aphides.**—*C.R. Acad. Sci. Fr.*, clxxxviii, no. 17, pp. 1118–1120, 3 figs., 1 ref. Paris, 1929.

Nicolle (C.) & Anderson (C.). **Un nouveau Spirochète récurrent pathogène pour le cobaye,** *Spirochaeta sogdianum*, **transmis par** *Ornithodorus papillipes*.—*Arch. Inst. Pasteur Tunis*, xvii, no. 4, pp. 295–309. Tunis, 1928. [*Cf. R.A.E.*, B, xvii, 17.]

Nicolle (C.), Anderson (C.) & Colas-Belcour (J.). **Etude expérimentale du Spirochète du gondi,** *Sp. gondii*.—*Arch. Inst. Pasteur Tunis*, xvii, no. 4, pp. 310–320. Tunis, 1928. [*Cf. R.A.E.*, B, xvii, 18.]

Nicolle (C.) & Anderson (C.). **Unicité des Spirochètes du groupe Dutton** [*Spirochaeta duttoni*].—*Arch. Inst. Pasteur Tunis*, xvii, no. 4, pp. 321–326. Tunis, 1928. [*Cf. R.A.E.*, B, xvi, 265; xvii, 17.]

Nicolle (C.), Anderson (C.) & Colas-Belcour (J.). **Adaptation expérimentale de Spirochètes récurrents à des Ornithodores autres que ceux qui les transmettent dans la nature.**—*Arch. Inst. Pasteur Tunis*, xviii, no. 1, pp. 50–52. Tunis, 1929. [*Cf. R.A.E.*, B, xvii, 62.]

Nicolle (C.), Anderson (C.) & Colas-Belcour (J.). **Premiers essais d'adaptation du Spirochète des poules** [*Spirochaeta gallinarum*] **à divers Ornithodores.**—*Arch. Inst. Pasteur Tunis*, xviii, no. 1, pp. 53–54. Tunis, 1929. [*Cf. R.A.E.*, B, xvii, 18.]

Kröber (O.). **Neue Beiträge zur Kenntnis der Thereviden und Tabaniden. (Dipt.)**—*Deuts. ent. Z.*, 1928, pt. 5, pp. 417–434, 19 figs. Berlin, 10th January 1929.

Mandoul (A. H.). **A propos des** *Culicoides* **de la région bordelaise.**—*Ann. Parasit. hum. comp.*, vii, no. 3, pp. 218–221, 5 refs. Paris, 1st May 1929.

Mathis (C.). **Biologie d'un moustique côtier du Var,** *Aëdes desbansi* **Séguy 1923.**—*Bull. Soc. Path. exot.*, xxii, no. 3, pp. 179–183. Paris, 1929.

Barraud (P. J.). **A Revision of the Culicine Mosquitoes of India. Part XXV. The Genera** *Mucidus, Mimomyia, Ficalbia, Rachionotomyia* **and** *Hodgesia*.—*Ind. J. Med. Res.*, xvi, no. 4, pp. 1052–1063, 1 pl. Calcutta, April 1929.

Guerricchio (A.). **Un caso de miasi intestinale.** [A Case of intestinal Myiasis caused by Agromyzine or Phytomyzine Larvae in Italy.] —*Arch. ital. Sci. med. colon.*, viii, no. 6, pp. 327–329. Tripoli, 1927.

SMIT (B.). **Observations on the Life History of the Sheep Maggot Fly, *Lucilia sericata*.—*Sci. Bull. Dept. Agric. S. Afr.*, no. 68, 12 pp., 1 fldg. diagram, 11 refs. Pretoria, 1928.**

An account is given of studies made in an insectary at Grootfontein, Cape Province, on the biology of *Lucilia sericata*, Mg., which is one of the three species of blow-flies that attack sheep in South Africa [*R.A.E.*, B, xv, 119], causing serious losses. Blow-flies only oviposit on sheep if the wool is damp and soiled; for the most part, they breed in carrion. There is no distinct strain that attacks live sheep; flies bred from maggots on sheep will readily oviposit on meat, and those bred from maggots in meat will oviposit on sheep. In the work dealt with in this paper, the main objects of which were to determine the number of generations that can be produced in a year in the Karroo area, the stage in which hibernation takes place and the lengths of the various stages at different seasons, *L. sericata* was reared on meat.

Considerable difficulty was at first experienced in breeding the flies, and the technique finally adopted is described in some detail, together with notes on the habits of the larvae and adults in captivity. The flies were placed in cylindrical gauze cages. These were 30 inches high, with conical tops covered with thick cloth to give protection from cold and high winds, and with sliding panels 8 inches square in the circular wooden bottoms, the diameter of which was 18 inches. Moisture was provided by means of petri dishes containing 30 per cent. sugar solution and muslin or a disk of blotting-paper floating on cork. Pieces of fresh meat weighing about ½ lb. were placed in evaporating dishes. For the first three days that eggs were laid, the dishes containing them were removed and placed under bell jars standing on plate glass; each jar had a large opening at the top for ventilation, covered with fine muslin or calico, and the bottom was ground so that it fitted closely to the plate glass. These precautions were necessary in order to prevent infestation of the meat by other flies and to prevent the entry of the Pteromalid, *Mormoniella vitripennis*, Wlk. (*Nasonia brevicornis*, Ashm.), which is very abundant throughout the summer, and can pass through the wire gauze walls of the insectary. When the larvae were nearly full-grown, the dish containing the meat on which they were feeding was placed on a larger dish half filled with dry sand. When all the larvae had left the meat and entered the sand, this was transferred to a jar covered with muslin. The first 50–100 flies that emerged were placed in a cage and provided with syrup and fresh meat. By these methods, nine successive generations were obtained between 17th September 1925 and 11th September 1926, and a tenth had begun.

The details of the length of each stage in the development of each generation, together with the maximum and minimum temperatures and the monthly rainfall throughout the period of the investigation, are shown in a diagram. The eggs are laid in quick succession in crevices in or under the meat; on exposure to the air, they dry rapidly and adhere to the meat and to one another, presenting a wax-like surface that is difficult to wet. The length of the egg stage varied from 8 hours to 3 days, according to the season, but all the eggs in a mass usually hatched within two hours of one another. The shortest feeding period was 2 days, in the summer, whereas in the autumn larvae remained in the meat for 19 days. As long as 5 days may elapse between the time when the first and last larvae of a batch leave the same piece of meat. The larvae feed by ejecting a digestive fluid from the mouth on to the meat,

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which is thus partially liquefied and rendered assimilable. They feed in closely packed masses, with their cephalic ends immersed in the liquid that they produce, and their caudal spiracles projecting above it. They need a good supply of fresh air when feeding, and are readily killed by the vapour of a poisonous gas such as carbon bisulphide.

In one case, larvae pupated within two days of leaving the meat, and in several cases the first of a batch pupated on the day on which the last of the same batch left the meat, whereas in other cases, particularly in the autumn, the first larvae of a batch did not pupate until more than 40 days after the last had left the meat ; the last larvae of one batch did not pupate until the following spring, 69 days after the last emergence from the meat. Some larvae remained active for 95 days after completing their feeding, and finally died without pupating. The ability of the larvae to suspend pupation under unfavourable conditions may be a very important factor in their survival.

The minimum length of the pupal stage was 7 days, in the summer (January), whereas it was estimated that some flies that emerged in the spring had spent 115 days as pupae, and in another jar the pupal period lasted at least 52 days. No flies emerged between 8th June and 11th September, although they were caught in traps throughout this period. The winter is therefore passed by *L. sericata* in the larval, pupal, and adult stages, but most frequently in the pupal stage. The length of life of the adults in the cages varied from 91 days in the spring to 35 days in the summer. During January and February, the hottest period of the year, the flies began to oviposit five days after emergence, and eggs were laid on the meat every day, whereas in September oviposition did not begin until 19 days after emergence. It is probably the greater activity and rapidity of egg-laying that accounts for the shorter life of the adults in hot weather. The total number of females was slightly larger than that of the males, but the proportions varied in different batches.

[Olenev (N. O.).] **Оленев (Н.О.). The chief Parasites of domestic Animals.** [*In Russian.*]—8vo, 25 pp., 6 pls., 9 figs., 39 refs. Leningrad, Narod. Kommiss. Zemled., 1929. Price, 60 *kop.*

This is an account of investigations made in the summer of 1928 by a special expedition to the Kazakstan Republic [former Turgaï and Syr-Darya regions] on Arthropods attacking domestic animals. Every year thousands die as a result of infectious diseases transmitted by ticks and flies ; and in some places the abundance of Argasids makes poultry-keeping impossible. A short general account is given of the Ixodids, the chief blood-sucking Diptera, and lice, and the morphology and bionomics of *Ixodes ricinus*, L., *Dermacentor niveus*, Neum., *Wohlfahrtia magnifica*, Schin., *Oestrus* (*Gastrophilus*) *intestinalis*, DeG., *Rhinoestrus purpureus*, Br., *Hypoderma bovis*, L., *Cephalomyia* (*Oestrus*) *ovis*, L., *Melophagus ovinus*, L., and *Argas persicus*, Oken, are very briefly discussed. The usual measures for the control of Arthropods attacking domestic animals are briefly reviewed. Against Tabanids, small pits should be dug in the pastures and filled with water covered with a film of kerosene, by which the flies are killed owing to their habit of plunging from time to time into the water.

NOGUCHI (H.), SHANNON (R. C.), TILDEN (E. B.) & TYLER (J. R.). *Phlebotomus* **and Oroya Fever and Verruga Peruana.**—*Science*, lxviii, no. 1769, pp. 493–495. New York, N.Y., 23rd November 1928.

Verruga is confined to certain mountainous parts of Peru, and Oroya fever, which has a similar distribution, appears to be a malignant form of it. Micro-organisms obtained in cultures made from blood taken from a case of Oroya fever, when inoculated into monkeys, reproduced diseases resembling both Oroya fever and verruga. The authors are of the opinion that the rod-shaped bodies, *Bartonella bacilliformis*, found in the blood of patients suffering from both forms of the disease, are carried by females of *Phlebotomus noguchii*, Shannon. There is some doubt whether *P. verrucarum*, Towns., also carries the disease, since the females are indistinguishable from those of *P. noguchii*. *P. peruensis*, Shannon, is probably not a carrier. Saline suspensions of the crushed sandflies were injected into the skin of monkeys, but no nodules developed. At regular intervals afterwards, cultures were made from the blood of the inoculated monkeys, with a view to determining whether the organism had infected the blood. Four different lots of *Phlebotomus*, tested in this way, were proved to carry *B. bacilliformis*. The inoculation of monkeys with the cultures produced experimental nodules, with recovery of *B. bacilliformis* from the blood and the nodular tissue. The evidence connecting *Phlebotomus* with Oroya fever and verruga is thus complete. Other blood-sucking Arthropods tested by inoculation were not found to harbour *B. bacilliformis*.

DEL PONTE (E.). **Nota previa sobre la bibliografía argentina y extranjera sobre los mosquitos argentinos y de su relación con el paludismo.** [A preliminary Note on the Argentine and Foreign Bibliography on Argentine Mosquitos and their Relation to Malaria.]—*Rev. Soc. ent. argent.*, ii, no. 2, pp. 81–94. Buenos Aires, 30th December 1928.

The first part of this list covers the epidemiology of malaria, the foreign titles extending from 1833 to 1901, and the Argentine ones from 1886 to 1911. The second part deals with entomology, and includes foreign literature on mosquitos, American papers on all Argentine CULICINAE except *Anopheles*, Argentine papers on CULICINAE and foreign papers on Argentine *Anopheles*.

VAN DER KODDE (W. F.). **The Presence of** *Xenopsylla astia* **in Semarang.**—*Meded. Dienst Volksgezondh. Ned.-Ind.*, Foreign edn., xvii, pt. 4, pp. 530–534. Batavia, 1928. [Recd. 1929.]

As the predominance of *Xenopsylla astia* in some parts of British India is the cause of greater immunity from plague in those areas, it was thought desirable to find out whether this might be one of the causes of the relative freedom of Java from plague. In the native quarters of Semarang, which have always been plague-free, 100 per cent. of the rat fleas examined proved to be *X. astia*. A further search for *X. astia* in that part of West Java hitherto free from plague is required, for if it be proved that this flea predominates there, measures must be taken to prevent the introduction of *X. cheopis*.

Reitler (R.) & Saliternik (H.). **Ueber Anophelenwanderung.** [On the Migration of *Anopheles*.]—*Arch. Schiffs- u. Tropenhyg.*, xxxiii, no. 3, pp. 170–181, 3 figs. Leipzig, March 1929.

In Palestine, *Anopheles sacharovi*, Favr (*elutus*, Edw.) has two periods of prevalence, in spring (April-May) and autumn (October-November) [*R.A.E.*, B, xiv, 128; xvi, 181]. The latter does not always occur, as the breeding-places may become dried up in the summer drought (May-November). On the other hand, it has been noticed that *A. sacharovi* occurred in abundance in certain localities near which no breeding-places could be found. This phenomenon was investigated in North Galilee, near Lake Huleh. In this region the adult mosquitos occur in Jewish and Arab villages and in the encampments of the semi-nomadic Bedouins. At certain periods they are also found in mountain caves and in the marshy thickets on Lake Huleh, in which *A. hyrcanus*, Pall., also abounds. Careful surveys in June, August, September and November showed that a sudden general migration of *A. sacharovi* occurs over greater distances than have hitherto been recorded. This migration occurs in two waves: a first and smaller one in October includes many males (35 per cent.), and a second and more prolonged one in November brings the majority of the females (12–15 per cent. males—the normal proportion). Evidence indicates that most of the migrants come from the extensive Huleh marshes. Passive carriage by wind is ruled out by the circumstances. By early December the mosquitos had withdrawn from human habitations to stables and store-houses, etc., where they hibernate. The males soon died, none being found after early December. This migration is evidently one to places where individuals have a better chance of surviving the period of hibernation. Dissections showed that females in summer have half or fully mature eggs, whereas from October onwards mature eggs were very rarely found, a fat-body that filled the abdominal cavity being present instead. All the migrant females were of this type. The disappearance of the males points to mating taking place during the migration, the maturation of the eggs being delayed until spring. As the winter rains create breeding-places in the new zones, the development of new generations from hibernated females can proceed undisturbed. Such an invasion of localities where gametocyte carriers reside is bound to give rise to an increase of malaria. Furthermore, the mosquitos can become infected before and during migration. To ascertain whether infected mosquitos can fly so far, transmitting malaria from the highly infected Huleh region to the little infected mountain region, dissections were made of *A. superpictus*, Grassi, and *A. sacharovi* in cellars, stables, etc., at Rosh Pinah, 2 oocysts and 2 sporozoites being found in 95 specimens of *A. sacharovi*, and none in 95 *A. superpictus*. This clearly indicates the importation of the infection, as *A. superpictus* breeds close to the locality.

Martini (E.). **Ueber Klima und Seuchen (vom Standpunkt des Entomologen).** [On Climate and Epidemics—from the Point of View of the Entomologist.]—*Anz. Schädlingsk.*, v, no. 4, pp. 45–48, 1 fig. Berlin, 15th April 1929.

This paper discusses briefly the various climatic factors that influence the occurrence of Arthropod vectors of disease. Their study is of

particular interest to the epidemiologist, because insect-borne diseases already show to what a considerable degree epidemics depend ultimately on meteorological and other natural phenomena.

[Kalandadze (L.).] **Каландадзе (Л.). Materialien zu der Faune und Biologie der Stechmüken in der S.S.R. Georgien.** [Data on the Fauna and Biology of Mosquitos in Georgia.] [*In Georgian.*]—*Nachr. trop. Med.*, ii, no. 3, pp. 183–197, 11 refs. Tiflis, March 1929. (With Summaries in Russian and German, pp. 254–256 & 259–260.)

The following is taken from the author's summary:—In 1928 the author collected a number of specimens of mosquitos from various parts of Georgia, which included *Anopheles maculipennis*, Mg., *A. sacharovi*, Favr (*elutus*, Edw.), *A. bifurcatus*, L., *A. superpictus*, Grassi, *A. hyrcanus* var. *pseudopictus*, Grassi, and *Aëdes argenteus*, Poir. (*fasciatus*, F.). Lists are given of mosquitos recorded previously from Georgia, including *Anopheles plumbeus*, Steph.

Yakimoff (W. L.). **Ueber die Rinderspirochätose in Russland (U.S.S.R.).** [Cattle Spirochaetosis in Russia.]—*Arch. Protistenk.*, lxvi, no. 2, pp. 311–321, 1 fig., 29 refs. Jena, 24th May 1929.

A case is recorded of spirochaetes being observed in the blood of a cow from Leningrad, infected with *Piroplasma bigeminum* by means of larvae of the tick, *Boophilus annulatus calcaratus*, Bir., brought from the North Caucasus, 20 days after the larvae were introduced into the animal's ear. *P. bigeminum* appeared after 17 days.

[Traut (I. I.).] **Траут (И. И.). Fleas and other Ectoparasites and Associates of *Citellus pygmaeus*, Pall., and Methods of eradicating them.** [*In Russian.*]—*Mater. Fauna Lower Volga Reg.*, pt. iii, pp. 53–96, 3 figs., 23 refs. Saratov, Lab. Study Poison Substances, 1929. (With a Summary in English, pp. 97–102.)

[Traut (I. I.).] **Траут (И. И.). The Effect of Calcium Cyanide on the Ectoparasites and Associates of Ground Squirrels. Results of a Study on Methods for a simultaneous Destruction of Ground Squirrels, their Associates and Ectoparasites.** [*In Russian.*]—*Rep. Lab. Study Poison Substances*, pt. vi, pp. 18–19 & 43–60, 3 figs., 12 refs. Saratov, 1929. (With Summaries in English, pp. 22 & 60–62.)

The second part of the first paper is reprinted from the second and third articles. The first part deals with the biology and ecology of fleas living in the burrows of *Citellus pygmaeus* and represents an attempt to determine the conditions under which the fleas may leave the burrows and thus disseminate the plague bacilli infecting them. A detailed account is given of investigations and experiments carried out in this connection in the years 1926–28 in the Stalingrad Government and the Kalmuik region. The character of these areas is described, and their flora and fauna are briefly reviewed. It was found that the fleas only inhabit burrows that contain the materials used by the ground squirrels for the building of nests, such as leaves, wool, feathers, grass stems, etc. A list is given of other insects occurring in the burrows; of these, various beetles and their larvae were the most numerous. The number and

species of fleas infesting the burrows of *C. pygmaeus* are discussed; they are more numerous in spring and autumn, whereas in June and July their number is considerably less. This is probably due to the habit of the squirrels of leaving their burrows in summer and carrying with them each time a certain number of fleas that subsequently remain in the field and die. That fleas do not remain long on their host in the open air is proved by the fact that they are never found on squirrels captured alive in traps. The species of fleas infesting *C. pygmaeus* were *Neopsylla setosa*, Wagn., *Ceratophyllus tesquorum*, Wagn. & Ioff, and *Frontopsylla semura*, Wagn. & Ioff; of these the first was the most abundant. Their means of distribution and transmission to man and animals are discussed in detail. Special experiments with cardboard pipes smeared with an adhesive and introduced into the burrows are described. The fleas never abandoned the burrows on their own account, and only rarely entered them from without. Fleas were never found in any part of the burrows other than the nest chamber, which shows that normally they are carried there by the ground squirrels. The fleas readily abandoned the nests and tried to make their way out of the burrows only when the latter were flooded with water; they never remained on a wet ground squirrel, although they might have been numerous on the animal immediately after it had been driven out of its burrow by water. The number of fleas infesting each squirrel was 5 on the average, but varied from 1 to 25. Fleas are also carried out of the burrows by *Putorius eversmanni*, which is frequently predacious on the ground squirrels, each individual destroying annually not less than 300 of the latter, and by *Lagurus lagurus* and *Microtus arvalis*, which also often occupy temporary and disused burrows.

The second part of the paper is a detailed account of preliminary experiments carried out by the author to find methods of destroying fleas and other fauna inhabiting the burrows of ground squirrels. Previous work in this connection [*R.A.E.*, B, xv, 126] is briefly reviewed. Experiments in isolating the fauna of the burrows for a considerable length of time, by tightly plugging the burrows after treating them with carbon bisulphide, showed that this method, even for 100 days, does not kill the fleas; the plugging of the burrows is, however, important in the control of plague in that it prevents other rodents from penetrating into the treated burrows and thus distributing the infected fleas. Experiments with chloropicrin, carbon bisulphide and calcium cyanide are described in detail. Pieces of cotton-wool soaked in chloropicrin at dosages varying from 0·5 to 4 gm. [about 8–64 grains] were introduced into the burrows by means of sticks 20–24 in. long, and the burrows then carefully plugged. Dosages of 0·5 gm. killed the ground squirrels, but did not affect the insect fauna; 4 gm. dosages killed fleas only in nests built not further than the middle of the second passage; as, however, the number of short and simple burrows is very limited, and the nests are usually built much beyond the second turning, the percentage of fleas killed is negligible. The main cause of the ineffectiveness of chloropicrin is its ready absorption by the nest material and the soil. Better results can be obtained when using very high dosages of chloropicrin, or with special apparatus for introducing the gas into the burrows in a highly concentrated form, especially at the furthest end. This, however, is very expensive and renders the use of chloropicrin economically impracticable.

The application of carbon bisulphide in 15 and 20 gm. dosages, introduced into the burrows by means of saturated cotton wool balls, resulted

in a partial, and in some cases complete, destruction of the fleas, besides killing the ground squirrels. Exploding the gas inside the burrows was very effective, and as small a dose as 4 gm. carbon bisulphide was sufficient to kill a number of fleas. Better results were obtained by using a 15 gm. dose, all the fleas and other fauna being killed in 50 per cent. of the treated burrows. Laboratory experiments in this connection are described in detail.

Calcium cyanide was ineffective, as the fumes did not penetrate far enough into the burrows.

ANDERSON (T. F.). **Some Investigations into the Incidence of Malaria in the Teita District.**—*Kenya & E. Afr. Med. J.*, vi, no. 1, pp. 2–11, 2 graphs. Nairobi, April 1929.

These investigations were made in three native reserves in southern Kenya, near the border of Tanganyika. In one, a very fertile area with numerous small streams and irrigation channels, 95 per cent. of the children under 10 had enlarged spleens, and malaria parasites were found in blood smears from 60 per cent. In this area, 99 per cent. of the Anopheline mosquitos caught in houses were *Anopheles funestus*, Giles, and the remainder *A. gambiae*, Giles (*costalis*, Theo.); larvae of the *funestus* group were found in all the small, shaded streams.

In the other two reserves, the inhabited parts of which are hills rising from a plain 2,000 feet above sea level to an altitude of over 7,000 feet, malaria is not endemic above 3,600 feet, whereas below this the spleen rate in children was found to be 30 per cent. At the higher altitudes, the rain water drains away more rapidly, and the streams are mostly swift, but some swamps occur, and *A. funestus* and *A. rhodesiensis*, Theo., were found in small numbers at all altitudes. Human reservoirs of infection are present in individuals who have contracted malaria at lower levels. The author suggests that the cold winds that prevail for a considerable part of the year lower the temperature to such an extent that the normal development of the malaria parasite in its Anopheline host is inhibited. *A. gambiae* was found only in four localities, which are among the most heavily infected, and in these places it occurred in large numbers. *A. transvaalensis*, Cart., *A. pretoriensis*, Theo., *A. maculipalpis*, Giles, *A. mauritianus*, Grp., and *A. cinereus*, Theo., were widely distributed below 3,600 feet.

INGRAM (A.) & DE MEILLON (B.). **A Mosquito Survey of certain Parts of South Africa, with special Reference to the Carriers of Malaria and their Control. Part II.**—*Pub. S. Afr. Inst. Med. Res.*, iv, no. 23, pp. 83–170, 26 figs., 16 refs. Johannesburg, January 1929.

This second report on mosquito surveys in South Africa [*R.A.E.*, B, xvi, 124] is divided into four sections. The first deals with a survey of the low veldt areas of the eastern Transvaal, one of the most malarious regions in South Africa, made during September, October and November 1927, the end of the dry season and beginning of the rains. The second section deals with a survey of part of eastern and northern Transvaal, made during a part of the malaria season, from 8th January to 6th April 1928, and the third with a brief survey of the Rustenburg district, in northern Transvaal, during the course of a serious epidemic

of malaria, 21st–24th April 1928. In the fourth section, descriptions are given of the hitherto unknown larvae or pupae of nine species of mosquitos, including the pupae of *Anopheles natalensis*, Hill & Haydon, and *A. theileri*, Edw.; the larva of *A. marshalli*, Theo., is also described, important differences being noted between specimens examined by the authors and the description given for larvae of this species in the Gold Coast by Ingram and Macfie [vi, 38].

In the first two sections, the areas surveyed are briefly described, details are given of the breeding-places of mosquitos, and recommendations are given for their control in each locality.

Most of the mosquitos were bred, but some were captured. The species taken in each locality are listed, with the habitat in which they were found. In the September-November survey, a few adults of *Anopheles gambiae*, Giles (*costalis*, Theo.) and *A. funestus*, Giles, were captured in a tent, and larvae of the former were plentiful at one place, but no larvae of either species were found elsewhere. In the January–April survey, a few adults of both species were taken, and larvae of *A. gambiae* were very numerous throughout, whereas those of *A. funestus* were comparatively rare. These observations on the seasonal incidence of *A. gambiae*, its scarcity in the dry season and abundance in the wet season, are in agreement with the observations of Lamborn in Nyasaland [xiii, 107] and of Hill and Haydon in Natal. The early occurrence of larvae of this species at one place may be accounted for by the lower elevation and higher temperature of that particular locality. The absence of larvae of *A. funestus* during the September–November survey may have been due to the difficulty of finding them, but may indicate that this species also has a seasonal prevalence in the Transvaal, and the authors are inclined to think that it does not oviposit in the winter, although in Nyasaland and the coastal belt of Natal its numbers fluctuate very little throughout the year.

The other Anophelines taken in the September-November survey were *A. rufipes*, Gough, *A. squamosus*, Theo., *A. maculipalpis*, Giles, *A. rhodesiensis*, Theo., *A. cinereus*, Theo., *A. mauritianus*, Grp. & Charm., *A. pretoriensis*, Theo., *A. longipalpis*, Theo., and *A. marshalli*. The first four species were collected only as larvae or larvae and pupae, and the remainder also as adults. The last two species, which occurred with some frequency, have hitherto been considered rare in South Africa. All these species, with the exception of *A. maculipalpis*, were also taken in the January-April survey, and in addition, *A. natalensis*, *A. theileri*, *A. nili*, Theo., *A. transvaalensis*, Cart., and *A. gambiae* var. *quadriannulatus*, Theo. Larvae of *A. pretoriensis* occurred much more commonly than those of any other species, being found in most pools, shaded or unshaded, that contained clear water. The next species in order of abundance was *A. gambiae*, the larvae of which were usually taken in shallow pools of muddy water, although they were found once in a kerosene tin and once in iron trucks, all these breeding-places being exposed to the sun. *A. cinereus* was found in marshy pools, backwaters and rock pools, either in shade or sunlight, and *A. squamosus* occurred in similar places. *A. funestus*, *A. longipalpis*, *A. nili*, *A. rhodesiensis*, *A. theileri* and *A. transvaalensis* were found chiefly at the edges of shady streams and rivers. *A. marshalli*, *A. mauritianus* and *A. maculipalpis* occurred in marshy areas, backwaters and overgrown, slow-flowing streams. *A. natalensis* was found only at the edges of rivers and swiftly running streams containing rocks. *A. rufipes* occurred in the same situations as *A. pretoriensis*, but much less commonly.

The Culicines collected included *Aëdes argenteus*, Poir., which was found with other species breeding in rot-holes in trees, chiefly *Sclerocarya caffra*, and also in a snail shell and in pools of water that had collected on a tarpaulin.

Further experience in field work tends to confirm the authors' previous opinion [xvi, 124] that *A. gambiae* and *A. funestus* are the principal vectors of malaria in South Africa, and that *A. gambiae* is the more important, since it is more abundant in the malaria season. The survey of the Rustenburg district during the malaria epidemic in April 1928 showed that *A. gambiae* was alone responsible for spreading the disease there; zygotes were present in the stomach of an engorged female of this species taken in a house. The only other Anophelines found in the district were *A. theileri* and *A. pretoriensis*, in one locality. This epidemic cannot be accounted for merely by an increase in the number of Anophelines due to heavy rainfall; other factors must have played their part, such as the gradual loss of the resistance to infection produced by a former epidemic and bad economic conditions.

In connection with the general prophylaxis of malaria [xvi, 125], the authors briefly discuss the recommendations of the Malaria Commission of the League of Nations [xv, 197; xvi, 147]. In accordance with the Commission's opinion that it is much better to carry out one or two indirect control measures thoroughly than to attempt several inadequately, the authors consider that in the outlying parts of the Transvaal and Zululand efforts should be concentrated on the education of the people in regard to the transmission of malaria by mosquitos and the elimination of *A. gambiae*, the latter being only possible with the help of the inhabitants.

STRICKLAND (C.). **Soap as a Mosquito Larvicide.**—*Trans. R. Soc. Trop. Med. & Hyg.*, xxii, no. 6, pp. 509–510. London, 25th April 1929.

In experiments to test the efficacy and cost of soap as a mosquito larvicide in swampy areas, a stock solution was made of 2 oz. of the kind of soap that forms an emulsion in brackish water with one pint of water. The effective strength was found to be 5 drachms of the stock solution to 1½ pints of water; at that strength all larvae were killed within 2 days but not all within 24 hours. This method was, however, very much more expensive than the use of kerosene. Field tests showed the soap to be less effective in the field than in the laboratory, and even in the laboratory it was found that, for a collection of 24 gallons of water 1 foot deep with 4 sq. ft. of surface, the soap was 48 times as costly as kerosene, and for the same volume of water 1 inch deep with 48 sq. ft. of surface it was 4 times as costly.

HACKETT (L. W.). **Malaria Control through anti-mosquito Measures in Italy.**—*Trans. R. Soc. Trop. Med. & Hyg.*, xxii, no. 6, pp. 477–506, 1 fig., 4 graphs, 9 refs. London, 25th April 1929.

A brief account is given of the work of the Malaria Experiment Station in Italy. The campaign in Portotorres, Sardinia, is described in detail. This was a highly malarious zone, in which about half the inhabitants had chronic malaria, and at least a quarter of them sought medical assistance during the year on account of the disease, which was about half benign tertian and half malignant tertian. The total cost

of malaria treatment was estimated at between £270 and £330 a year, and during four years about £245 a year has been spent in anti-larval measures. The Anophelines present were *Anopheles maculipennis*, Mg., and occasionally *A. sacharovi*, Favr (*elutus*, Edw.), both of which are malaria carriers, and *A. algeriensis*, Theo., which could be ignored. Experience proved that the use of Paris green as a larvicide was by far the most efficient anti-larval measure. So successful was the campaign that in three years' time Portotorres was becoming a pleasure resort instead of a place where nobody but the natives would spend a night. The quinine prophylaxis, which was also carried on during the first year, is described.

At Bianconovo, in the extreme south of Italy, anti-larval measures were introduced as the only new factor in a stable malarious situation that had existed for many years, and although no quinine was administered, malaria had practically disappeared there also within three years. This confirms the finding of Kligler, that, with reasonably effective mosquito control, intensive quininisation of chronic cases in the first year has no effect in accelerating the disappearance of malaria. In the course of the work it was always found (contrary to what has sometimes been stated) that intense endemic malaria was always associated with considerable Anopheline density, and almost complete disappearance of malaria was found compatible with imperfect domination of Anophelines. It is not suggested that anti-mosquito measures should be confined to the use of larvicides; it is far better, wherever possible, to abolish breeding-places than merely to keep them under control. Underground tile drainage, for example, is considered a valuable measure, but the campaigns described were limited by the preference of *A. maculipennis* for types of water that cannot well be abolished in Italy. In most cases the use of larvicides should be in the nature of a temporary expedient for controlling malaria until more permanent measures suppress the breeding of Anophelines.

Southern Rhodesia : Tsetse Fly Act, 1929.—2 pp. [Salisbury] 1929.

This Act to provide for regulating traffic to and from areas in Southern Rhodesia infested with tsetse-fly [*Glossina*] defines the power of the Governor to declare any area to be a tsetse-fly area, to make regulations for prohibiting or restricting the movement of persons, domestic animals, or vehicles to, from, or within such an area, and to provide for inspection and any other measures necessary to prevent the spread of the fly.

Chamberlain (W. P.) & Curry (D. P.). **Mosquito and Malaria Control Work.**—*Rep. Hlth. Dept. Panama Canal 1927*, pp. 17–21. Balboa Heights, C.Z., 1928. [Recd. 1929.]

An account is given of an extension of the drainage system for the control of malaria-carrying Anophelines for a further two miles along the coast east of Panama made during 1927. A total of over 34,000 feet of open ditch was dug in the vicinity of the ruined city of Old Panama, where large areas of marshy pasture lands afford breeding grounds for great numbers of *Anopheles albimanus*, Wied., each rainy season.

Larvae of *Taeniorhynchus* (*Mansonia*) *titillans*, Wlk., which had hitherto been found only on water lettuce (*Pistia*), have recently

been discovered attached to a floating grass, which has been identified as *Paspalum repens*. This grass, which appears to be spreading rapidly in the artificial lakes of the Canal system, is particularly suited as a source of air supply to the peculiar needs of *T. titillans*, so that a sudden increase of this mosquito is likely to occur. An attempt is being made to control the larvae with an oil spray, but the presence of strong currents in the lakes makes this difficult.

In the northern district on the Atlantic side of the Canal Zone, where attention has been mainly confined to perfecting the existing system rather than to extending the treated area, surface drainage has converted many shallow weed-filled ponds into wet meadows where water only stands in the depressions. *A. albimanus*, Wied., *A. tarsimaculatus*, Goeldi, *A. argyritarsis*, R.-D., and *A. pseudopunctipennis*, Theo., no longer breed there except in ditches that have become choked, and *A. apicimacula*, D. & K., and *A. punctimacula*, D. & K., the only species now found in surface depressions, are not considered important transmitters of malaria. The hitherto unknown larva of *Anopheles* (*Stethomyia*) *nimbus*, Theo., was discovered in shaded pools associated with *A. eiseni*, Coq., *A. punctimacula*, and *Culex declarator*, D. & K.

In view of the great recent extension of treated areas and the thorough application of control measures, residual malaria still occurring in the towns is thought to be due to mosquitos that have flown from comparatively far away. The sources of the flights of malaria-carrying Anophelines to which the towns are still subject in the early weeks of the rainy season are well beyond the regions under observation, although search has been greatly extended in efforts to locate them.

CUTRIGHT (C. R.). **A valuable Aid in the Control of the Feather Mite, *Liponyssus sylviarum*.**—*J. Econ. Ent.*, xxii, no. 2, p. 422. Geneva, N.Y., April 1929.

An infestation of *Liponyssus sylviarum*, C. & F., that occurred in January 1929 among poultry in Ohio was temporarily controlled by painting the perches with nicotine sulphate and dusting the nests with sulphur, after dipping, painting and spraying the houses with creosote and kerosene had proved a total failure. The presence of *L. sylviarum* was first indicated by the appearance of large numbers of mites on the eggs, which seems to be a characteristic sign of infestation. Mites began to fall from the birds 15 minutes after they had settled on the treated roosts, and thousands of dead mites were found next morning on paper placed beneath them. A month after treatment there was still no sign of the mites on either the eggs or the birds.

GATER (B. A. R.) & RAJAMONEY (P. D.). **A Summary of Records of Anopheline Breeding-places in Malaya.** *Bull. Inst. Med. Res. F.M.S.*, no. 2 (1929), 33 pp., 4 refs. Kuala Lumpur, 1929.

The existing records of mosquito breeding-places in the Federated Malay States, which are collated in this bulletin, are the result of 20,318 collections of Anopheline larvae and the identification of 126,176 individual specimens by several investigators over a considerable period of time and are published with a view to aiding those engaged in mosquito surveys. In the first part a summary of the breeding-places of each species is given and in the second part the

breeding-places are described in more detail. A table giving the species taken in the various types of breeding-places shows that, with the exception of the specialised bamboo breeders, every species has been found in pools, and 19 and 13 species in drains and wells respectively, indicating the necessity for careful supervision of such places. Eleven species have been taken, though rarely, in the so-called artificial breeding-places, a fact that emphasises the adaptability of most Anophelines in Malaya. The country as a whole has not yet been surveyed, and the localities from which the records were obtained are restricted. Definite conclusions cannot, therefore, be formed from the figures available, but the most important point brought out is that the selection of specific breeding-places appears to be confined to very few species, and the authors are of the opinion that most Anopheline larvae are far more adaptable than is generally believed to be the case. Dr. W. T. Quaife, in carrying out experiments to test the suggestion that *Anopheles maculatus*, Theo., prefers very clean water, found that it not only continued to breed in water made foul with decomposing scrap rubber, etc., but increased in numbers, and although it disappeared for a short time from water contaminated with fresh cattle manure, it re-appeared in large numbers despite the fact that the manure was slowly disintegrating in the water.

FAUST (E. C.). **Mosquitoes in China and their potential Relationship to Human Disease.**—*J. Trop. Med. & Hyg.*, xxxii, no. 10, pp. 133–137, 1 map, 16 refs. London, 15th May 1929.

Malaria is responsible for a large proportion of the illness and a considerable amount of mortality in China, particularly in the area south of 25° N. latitude, where the humidity and temperature are sufficiently high throughout the year for the breeding of Anophelines and for the development of malarial parasites in them. Extensive infection occurs in central China, between 25° and 35° N. latitude, and all three types of malaria are present in this region, but the temperature frequently approaches freezing point, so that mosquito breeding is checked during the winter, although the humidity is adequate. North of the thirty-fifth parallel, the annual rainfall drops rapidly below 75 cm. (29·5 in.), and malignant tertian (aestivo-autumnal) and quartan malaria are not endemic. Around Peking the annual rainfall is 50 cm. (19·7 in.), and on the more elevated Shansi plain to the west, it is only 25 cm. (9·8 in.) ; the moist season is confined to about two months in the summer, and this, combined with the extreme dry cold of the winter, limits the breeding season of mosquitos to a few months. Benign tertian malaria is endemic around Peking, but has not become established in the Shansi plain. No experimental work has been carried out in China proper to determine the species of *Anopheles* that transmit malaria.

The known distribution of the various species of Anophelines in China and adjacent countries is shown on a map [*cf. R.A.E.*, B, xv, 26]. *A. hyrcanus* var. *sinensis*, Wied., is the commonest throughout China proper, and is the only one recorded from the central region, between the twenty-fifth and thirty-fifth parallels, with the exception of *A. gigas*, Giles, at Chungking, far up the Yangtsze valley, and it is highly probable that it is the normal primary source of infection throughout central and northern China, although *A. pattoni*, Christophers, cannot be excluded from consideration in the north

until more is known about it [*cf.* xvi, 42]. The northern limit of the strictly Oriental species lies just north of the twenty-fifth parallel, but even south of this *A. hyrcanus* var. *sinensis* is the commonest Anopheline around houses, and the readiest to suck blood. In certain districts south of this line, however, *A. maculatus*, Theo., and to a less extent *A. maculipalpis*, Giles, and *A. minimus*, Theo., must be seriously considered. North of the fortieth parallel, in the province of Shansi, and in Manchuria and the Maritime Province of Siberia, where benign tertian malaria occurs, the only Anopheline known is *A. maculipennis*, Mg.

Epidemics of dengue have occurred from time to time in China as far north as Hangchow and Shanghai, and in Formosa. The only mosquito that has been proved to transmit this disease, *Aëdes argenteus*, Poir. (*aegypti*, L.), extends northwards along the coast only as far as Amoy and Formosa. From the Hainan Straits northwards, *A. argenteus* tends to be replaced by *A. albopictus*, Skuse, which is the most closely related species with a distribution corresponding to that of dengue.

Filariasis in China is caused only by *Filaria* (*Wucheria*) *bancrofti*. It is prevalent along the coast as far north as the southern part of Shantung Province, its northern limit being the thirty-fifth parallel and the 75 cm. precipitation line ; it also extends up the Yangtsze at least as far as Chungking. It is reasonable to suppose that *Culex fatigans*, Wied., is the primary intermediate host in the southern part of the area, where it is the commonest mosquito ; *C. pipiens*, L., which replaces *C. fatigans* north of the Yangtsze, has been definitely incriminated in the northern part of Kiansu Province [xv, 27]. Further investigations on the possible vectors of *F. bancrofti* in China are, however, needed.

Blanc (G.) & Caminopetros (J.). **Quelques observations épidémiologiques faites aux environs d'Athènes pendant l'épidémie de "dengue." L'enseignement qu'on en peut tirer.**—*Rev. Hyg. Méd. prév.*, li, no. 3, pp. 161–171, 8 figs., 12 refs. Paris, March 1929.

During the recent outbreak of dengue in Greece, the view that *Aëdes argenteus*, Poir. (*Stegomyia fasciata*, F.) is responsible for its transmission was questioned, firstly because the distribution of this mosquito in Greece was believed to be limited, and secondly because many doctors were of the opinion that there is no difference between dengue and three-day (sandfly) fever, which is transmitted by *Phlebotomus*. The distribution of *Aëdes* in Greece is discussed, and it is pointed out that the medical men that followed the recent outbreak clearly differentiated between dengue and three-day fever.

The authors give an account of observations in two villages and a large hospital on the outskirts of Athens that definitely bear out the conclusions obtained from recent experiments [*R.A.E.*, B, xvii, 62]. In the first village, situated about two miles outside Athens, almost the entire population of over 500 persons suffered from the disease, and investigation revealed the presence of large numbers of *A. argenteus* in the houses, while eggs and larvae were abundant in the village water supply, comprising a system of canals and open domestic reservoirs.

About a mile further along the same road was a hospital containing about 740 persons, in which the only cases of dengue that occurred had been contracted in Athens at the beginning of the outbreak. Although these cases were cared for at the hospital, no one else contracted the disease. Here the water supply system was entirely enclosed, and no *A. argenteus* was found. On the other hand, sandflies and also *Culex* were present.

In another village, some 500 yards away, where there was no stagnant water and no open receptacles for it, mosquitos were absent, and though some of the inhabitants contracted dengue at the Piraeus, the remainder did not become infected, despite the abundance of *Phlebotomus* and the crowding of families in small houses.

MORIN (H. G. S.). **Sur la présence de** *A.* (*Myzomyia*) *karwari* **en Cochinchine.**—*Bull. Soc. Path. exot.*, xxii, no. 4, pp. 253–255, 1 ref. Paris, 1929.

The occurrence of *Anopheles karwari*, James, is recorded from about 75 miles north of Saïgon, and the characters distinguishing the larvae and adults from those of *A. maculatus*, Theo., are given. *A. karwari*, which has not previously been recorded from Indo-China, is frequently associated with *A. maculatus* in the larval stage, but whereas the latter is an important vector of malaria throughout the Far East, *A. karwari* has never been found to be naturally infected.

CAZANOVE (F.). **Notes épidémiologiques sur l'épidémie de fièvre jaune du Sénégal en 1927.**—*Bull. Soc. Path. exot.*, xxii, no. 4, pp. 260–272. Paris, 1929.

The author briefly reviews the outbreaks of yellow fever in Senegal from 1829 to 1927, and discusses the last one in some detail. He concludes that all the recent outbreaks have originated from an endemic focus in the Sine-Saloum district in the south of the Colony, north of the Gambia, or in the Gambia itself. In view of the extreme difficulty of controlling *Aëdes* (*Stegomyia*) [*argenteus*, Poir.] over large areas, the author suggests that an attempt should be made to discover the exact location and extent of those in which the disease is endemic, by inoculating blood from natives into monkeys. If foci were found to exist within French territory, control measures should be concentrated on them ; if not, stricter supervision of the movement of natives over the land frontiers should be enforced.

CARDAMITIS (J. P.). **La dengue en Grèce.**—*Bull. Soc. Path. exot.*, xxii, no. 4, pp. 272–292. Paris, 1929.

An account is given of epidemiological and other observations made during the epidemics of dengue in Greece in 1927 and 1928, chiefly in Athens and in the island and town of Aegina, 17 miles south-west of the Piraeus.

Phlebotomus papatasii, Scop., is the commonest sandfly in Greece, where it is found up to an altitude of at least 3,280 feet. *P. minutus*, Rond., is less common. *P. papatasii* is purely a domestic species,

the adults feeding on man and warm-blooded animals, and frequenting principally shaded rooms of the ground or first floor in houses, stables, damp places in gardens, sewers, ditches, etc. The adults of *P. minutus* frequent ruined buildings, and feed on cold-blooded animals such as lizards. In Greece, the adults of *P. papatasii* appear in April, become abundant in May and June and again in the moist period of the autumn, and persist until the winter. Houses should be searched for sandflies within a short time before or after sunrise. Later in the day, they hide in crevices, and may be searched for in vain even when they are numerous.

The adults of *Aëdes argenteus*, Poir. (*Stegomyia fasciata*, F.) become active in April and disappear about December or earlier ; they hibernate in cellars, etc., but come out into the open occasionally on fine days during the winter, when they suck blood. Each female lays 60–95 eggs ; these require a temperature of 25–30° C. [77–86° F.] to hatch, but can survive temperatures below freezing point. The eggs are laid in small collections of clean or dirty water around houses. Water containing starchy substances is generally avoided, whereas the presence of nitrogenous matter, particularly human excrement, renders water attractive to the ovipositing female. Under favourable conditions, the transformation from egg to adult occupies 11–15 days. The first blood meal is taken during the day, on the second day after emergence, subsequent ones being taken at night. At a temperature of 26–32° C. [78·8–89·6° F.], mating takes place 2–3 days after the first blood meal, usually during the hottest period of the day. Mating does not take place when the temperature is below 20–22° C. [68–71·6° F.].

It has been assumed, because of the abundance of *A. argenteus*, and because of the positive results obtained in transmission experiments with this species by the Pasteur Institute of Athens [*R.A.E.*, B, xvii, 62], confirming experiments carried out in other parts of the world, that *A. argenteus* was solely or mainly responsible for the epidemics in Greece. At Aegina, however, the author searched the houses thoroughly, and found *A. argenteus* in a few only, whereas *P. papatasii* was present in numbers in every house, 50 being seen for every individual of *A. argenteus*, and the stomachs of nearly all the sandflies contained blood. Very little systematic search of houses was done by other workers in Athens, and *P. papatasii* was overlooked by them, but the author found that even there this sandfly was as numerous as *A. argenteus*. In the autumn, *A. argenteus* had become rare by the middle of October, when the mean temperature was about 15° C. [59° F.], but fresh cases of dengue continued to occur, although at that temperature *A. argenteus* no longer sucks blood.

It has been suggested that the virus of dengue was preserved during the winter of 1927–28 in the bodies of hibernating females of *A. argenteus*, these mosquitos providing a link between the epidemics of 1927 and 1928, but the author considers this to be very improbable. The occasional occurrence of cases of dengue in mid-winter has not, however, been explained. Moreover, outbreaks of dengue or sandfly (three-day) fever have been reported from places at altitudes up to 6,560 feet in Greece. It seems probable that there is some means other than the bite of *A. argenteus* or *P. papatasii* by which this disease may be transmitted [*cf. R.A.E.*, B, xvii, 56].

The clinical aspects of dengue and sandfly fever are compared, and it is pointed out that the symptoms are almost identical. Since both are believed to be caused by a filtrable virus that undergoes development

in the body of an insect, *A. argenteus* in the one case and *P. papatasii* in the other, the author considers that the virus of the two diseases is identical; he puts forward the theory that when both *A. argenteus* and *P. papatasii* are present during an epidemic, the mild cases of short duration are probably caused by the bite of the latter, and the more severe ones of longer duration by that of the former. The author also suggests that the occurrence of serious cases at the hottest period of the summer is due to the more rapid increase of the virus in the insect during hot weather.

NICOLLE (C.), ANDERSON (C.) & HORNUS (P.). **Sur un nouveau spirochète d'un cas de fièvre récurrente du Maroc.**—*C.R. Acad. Sci. Fr.*, clxxxviii, no. 19, pp. 1211–1213. Paris, 1929.

A new spirochaete causing relapsing fever, pathogenic to guineapigs, white rats, mice and monkeys, is recorded from the blood of a European in Bou Znika. Its severe infectivity for the guineapig places it in the same group as *Spirochaeta hispanica* from Spain, *S. hispanica* var. *marocana* from Mansouria and *S. sogdiana* from Russian Turkestan [*R.A.E.*, B, xvii, 17]. A first attack of spirochaetosis caused by this organism confers complete immunity against the Spanish virus for 15 days, and almost complete for a month. *S. hispanica*, however, gives no immunity against the new form, which itself neither gives immunity against nor receives it from that of Mansouria.

Its natural vector is *Ornithodorus marocanus*, Velu. Attempts to transmit either it or the Mansouria type to lice [*Pediculus*] were unsuccessful.

To avoid creating further names for the various spirochaetes of relapsing fever in Morocco, belonging to the same group and transmitted by the same tick, the authors suggest that the new spirochaete should be known as *S. hispanica* var. *marocana* of Bou Znika and that of Mansouria as *S. hispanica* var. *marocana* of Mansouria.

PAPERS NOTICED BY TITLE ONLY.

TEGONI (G.) & WILLIAMS (B.). **Indice bibliografico della malaria. Index to the Literature on Malaria. II. 1927.**—*Riv. Malariologia*, viii, Suppl., 106 pp. Rome, 1929.

DYAR (H. G.). **A new Species of Mosquito from Montana, with annotated List of the Species known from the State.**—*Proc. U.S. Nat. Mus.*, lxxv, art. 23, no. 2794, pp. 1–8. Washington [D.C.], 1929.

FLETCHER (T. B.) & SEN (S. K.). **A Veterinary Entomology for India, VIII. Section 3. The internal Anatomy of Diptera.**—*J. Central Bur. Anim. Husb. Dairying India*, iii, pt. 1, pp. 17–30, 18 figs. Calcutta, 1929. [*Cf. R.A.E.*, B, xvii, 103.]

SOESILO (R.). **The experimental Susceptibility of** *M. rossi* [*Anopheles subpictus*, Grassi] **for malarial Infections.**—*Meded. Dienst Volksgezondh. Ned.-Ind.*, Foreign edn., xvii, pt 4, pp. 509–514, 10 refs. Batavia, 1928. [*See R.A.E.*, B, xvii, 84.]

Blanc (G.) & Caminopetros (J.). **Durée de conservation du virus de la dengue chez les Stégomyas. L'influence de la saison froide sur le pouvoir infectant.**—*C.R. Acad. Sci. Fr.*, clxxxviii, no. 19, pp. 1273–1275, 2 refs. Paris, 1929.

The authors carried out further experiments on the transmission of dengue in Greece by *Aëdes argenteus*, Poir. (*Stegomyia fasciata*, F.) [*R.A.E.*, B, xvii, 62] to determine the duration of infection in the mosquito and the effect of temperature on its preservation and the duration of incubation.

Mosquitos infected either naturally or experimentally with the virus of dengue were kept alive for at least 200 days, from the autumn of 1928 to the spring of 1929. As long as the temperature was above 18° C. [64·4° F.], they retained their power of infection, but lost it when the average temperature fell below this. The virus was not, however, destroyed, since they became infective again when the average temperature rose above 18° C. They can transmit the disease at least 174 days after being infected, and can thus maintain the virus through the winter from one year to the next. Mosquitos fed on an infected person on 22nd December, when the outdoor temperature was 15° C. [59° F.], only became infective when the average temperature rose above 18° C., on 5th April, after being kept at 16° C. [60·8 F.] for 104 days.

Sergent (Edm.) & Sergent (Et.). **Vingt-cinq années d'étude et de prophylaxie du paludisme en Algérie.**—*Arch. Inst. Pasteur Algérie*, vi, no. 2–3, pp. 117–434, 148 figs., bibliography. Algiers, 1928.

The first part of this review of 25 years of experience in the control of malaria in Algeria includes a brief account of the theatre of operations; a history of experimental research carried out between 1902 and 1926; a résumé of the prophylactic and epidemiological measures employed and the results obtained; a record of certain anti-malarial experiments and campaigns carried on outside Algeria; and reports from individual fields of experiment within the country. The second part consists of an analytical bibliography dealing with 128 works arranged under the following headings: classification and biology of mosquitos; haematozoa, haematology of creatures susceptible to malaria, malaria in birds; prophylactic measures and anti-malarial campaigns; and a list of 22 papers concerning instruction and propaganda.

Hue (C. H.), Huie (D.) & Lee (C. U.). **Slapping as a Factor in Transmission of Kala-Azar by Sandflies** (*Phlebotomus*).—*Proc. Soc. Exp. Biol. & Med.*, xxvi, no. 4, pp. 280–284. New York, January 1929. (Abstract in *Bull. Inst. Pasteur*, xxvii, no. 9, p. 416. Paris, 15th May 1929.)

Experiments were carried out to determine the importance of crushing infected *Phlebotomus* on the skin at the moment of biting as a natural factor in transmitting kala-azar. Sandflies infected by a process already noticed [*R.A.E.*, B, xvii, 148] were allowed to engorge after 6–10 days from a piece of flannel soaked in defibrinated rabbit blood through a piece of skin taken from a healthy hamster. The sandflies

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were crushed by a special implement at the moment of biting, and the piece of flannel was subsequently placed in a tube containing a nutritive medium in order to secure cultures of any flagellates that the insect might have introduced through its proboscis. One positive result was obtained out of 27 tests, whereas negative results only were secured in 9 tests of biting without crushing. The authors consider this a proof that kala-azar can be transmitted by this means and add that if crushing is a necessary factor in transmission, the immunity of young children may be accounted for by their inability to defend themselves when bitten.

PARKER (R. R.). **Quail as a possible Source of Tularaemia Infection in Man.**—*Pub. Hlth. Rep.*, xliv, no. 17, pp. 999–1000, 1 ref. Washington, D.C., 26th April 1929.

In an investigation to determine whether tularaemia occurs as a natural infection of game birds, five quails (*Colinus virginianus*) were fed on grain moistened with an emulsion from guineapigs that had died of tularaemia. Two of them died in 6 days and three in 8 days after this feed. Injections from the quails into 10 guineapigs produced death from tularaemia in every case within four days. Quails are known to be frequent hosts of the rabbit tick, *Haemaphysalis leporis-palustris*, Pack., and the histories of two cases occurring in the southern United States indicate these birds as a possible source of human infection. The results warrant their being treated as at least potential agents of human infection with tularaemia.

LEPRINCE (J. A.) & JOHNSON (H. A.). **Development of a Power Dusting Device for applying Paris Green as an Anopheline Larvicide.**—*Pub. Hlth. Rep.*, xliv, no. 17, pp. 1001–1017, 13 figs., 12 diag., 3 refs. Washington, D.C., 26th April 1929.

A light, portable power blower, which can be set up in a small boat and operated by one man for the distribution of Paris green over water as an Anopheline larvicide is described, with details of its construction and working. Various brands of Paris green were tried, the most successful of which gave the best results when mixed at 15 per cent. strength with hydrated lime as a diluent. By the passage of the dust through an impeller, it is thoroughly broken up, disintegrated and mixed. The blower has an extremely high discharge velocity, carrying the dust effectively up to at least 525 feet from the path of liberation. With the increasing use of Paris green as a larvicide throughout the world, the importance of standardising the specifications, so that high toxicity against Anopheline larvae may be assured, cannot be over-emphasised. At present, the toxic value of each lot should be tested before use on a large scale.

KNOWLES (R.), Ed. **The Indian Medical Year, 1928.**—*Ind. Med. Gaz.*, lxiv, no. 5, Suppl., 36 pp. Calcutta, May 1929.

This is a review of the medical work in India in 1928, including the latest discoveries and investigations with regard to malaria, plague, kala-azar, tick-typhus and medical entomology generally.

Achundow (I.). **Ein weiterer Beitrag zum Rassenproblem der Anophelen.** [A further Contribution to the Question of Races of *Anopheles*.]—*Arch. Schiffs- u. Tropenhyg.*, xxxiii, no. 4, pp. 215–219, 3 refs. Leipzig, April 1929.

In continuation of studies on the production, by different coloured containers for the larvae, of differences in the colour and size of Anophelines [*R.A.E.*, B, xvii, 32], the question was investigated whether races could be formed in this manner or whether at least there is some effect on the next generation. It was first necessary to ascertain if the quality of the food played any rôle and also whether it was possible that the variation in size was due, not to a direct effect of light, but to a development by light of the microfauna or flora on the food material used.

In the present experiments the first-stage larvae of *Anopheles maculipennis*, Mg., were placed in the containers of various colours, but were fed with yeast powder instead of " Piscidin " as previously. The same differences in colour resulted as in the previous experiments, the larvae from the green container being more distinctly greenish in the present case. In breeding tests, two aquaria were used, painted white and black respectively. First-stage larvae and eggs of *A. maculipennis* were placed in these. The larvae in the black container were black and somewhat smaller than those in the white container, which were large and yellowish white. The pupae showed the same differences, and when they were placed (one, two or three days after pupation began) in two containers reproducing natural conditions, the resultant adults of each series were still dark and light. Most of the eggs obtained from both lots of adults resemble one kind of the black eggs recorded by Falleroni [B, xv, 71]. The larvae and pupae from these eggs do not (under natural conditions) resemble their parents in any way. They are smaller and greenish to light-brown, and the resultant adults are not distinctively dark or light-coloured. Others of these larvae and pupae, placed in white and in black containers, produced the modifications of colour previously obtained. It is evident therefore that though the effects of external conditions are very great, no effects on the next generation are produced.

Graf (—). **Beitrag zur Pathologie des *Glossina palpalis*-Stichs und der Inkubationszeit bei Schlafkrankheit.** [A Contribution to the Pathology of the Bite of *G. palpalis* and of the Incubation Period in Sleeping Sickness.]—*Arch. Schiffs- u. Tropenhyg.*, xxxiii, no. 4, pp. 219–222. Leipzig, April 1929.

A case is recorded in which trypanosomes appeared in the blood of a patient two days after having been bitten by *Glossina palpalis*.

Bevan (L. E. W.). **Trypanosomiasis.**—*Rep. Vet. Res. S. Rhodesia 1928*, pp. 5–8. Salisbury, 1929.

An account is given of a method of treating cattle against trypanosomiasis based on observations with *Trypanosoma congolense* in Southern Rhodesia in which the animals are inoculated with a pure strain of the trypanosome and subsequently treated with antimony, thus producing artificially an immunity that had frequently been observed in nature when naturally infected animals that had recovered as a result of

treatment were re-exposed to infection by tsetse-flies [*Glossina morsitans*, Westw.]. It is suggested that this method may lead to the opening up of millions of acres of valuable territory in tropical and subtropical Africa, but an objection has been raised on the grounds that it will involve the occupation of tsetse-fly areas with infected animals, and that they will supply nourishment and infection to the fly and possibly lead to an increase in its numbers. It is pointed out, however, that the fly in such areas can probably obtain all the nourishment required from game and small animals and that its numbers would not be materially increased by the introduction of cattle. Moreover, the opening up of mines and farms and the consequent felling of timber and clearing of forest would probably interfere with the breeding-places of the fly.

AUSTEN (E. E.). **A New Tsetse-fly of the *Glossina palpalis* Group occurring in Belgian Congo.**—*Bull. Ent. Res.*, xx, pt. 1, pp. 1–4, 5 figs. London, May 1929.

Glossina newsteadi, sp. n., is described from the Belgian Congo, where it was found in association with *G. palpalis*, R.-D. This discovery brings the number of recognised species of *Glossina* up to twenty.

BEATTIE (M. V. F.) & HOWLAND (L. J.). **The Bionomics of some Tree-hole Mosquitos.**—*Bull. Ent. Res.*, xx, pt. 1, pp. 45–58, 2 pls., 6 figs., 12 refs. London, May 1929.

A systematic investigation of three rot-holes in beech trees in Buckinghamshire was carried out over a period of a year from February 1928. The mosquito fauna consisted of *Aëdes* (*Finlaya*) *geniculatus*, Ol., *Orthopodomyia pulchripalpis*, Rond., and *Anopheles plumbeus*, Steph.; the larvae of the last-named species were found throughout the year, the highest incidence occurring from September to December. A detailed study of the physico-chemical factors of the environment indicated that there was no correlation between larval incidence and hydrogen-ion concentration, dissolved oxygen, chlorides, solids, or ammonia nitrogen, but that the total organic nitrogen content was probably an important factor in determining the selection of breeding-places. An examination of the gut contents of the various larvae revealed the presence of small algae, a few animals, bacteria, and considerable quantities of rotting vegetation. The algal and animal food appeared to be insufficient for the anabolic processes of the larvae; bacteria may play some part in their nutrition, and it is suggested that the larvae are able to utilise any food constituents present in the vegetable débris. The organic nitrogen content will partly depend on the quantity of débris, and it is possible that débris of such high nitrogen content is a suitable food.

PARKER (R. R.), BROOKS (C. S.) & MARSH (H.). **The Occurrence of *Bacterium tularense* in the Wood Tick, *Dermacentor occidentalis*, in California.**—*Publ. Hlth. Rep.*, xliv, no. 22, pp. 1299–1300, 3 refs. Washington, D.C., 31st May 1929.

An unrecognised pathological condition recently occurred in cattle in California heavily infested with *Dermacentor reticulatus occidentalis*,

Marx (Pacific coast tick). Injection of ticks from an affected animal into guineapigs caused lesions indicative of tularaemia and sub-inoculation from these guineapigs produced characteristic lesions. Serum from infected cattle agglutinated *Bacterium tularense* completely in dilutions up to 1 : 40 and *Brucella abortus* in dilutions up to 1 : 20. The data obtained are not sufficient to justify any assumption as to what part *B. tularense* might have played in the pathology of the affected cattle, but the demonstration of natural tularaemia infection in adults of *D. reticulatus occidentalis* is of importance, as this tick, which is common in many parts of California and in south-western Oregon, is frequently a parasite of man.

BARBER (M. A.), KOMP (W. H. W.) & KING (C. H.). **Malaria and the Malaria Danger in certain irrigated Regions of southwestern United States.**—*Publ. Hlth. Rep.*, xliv, no. 22, pp. 1300–1315, 3 refs. Washington, D.C., 31st May 1929.

Large areas in the arid or semi-arid regions of the south-western United States have been reclaimed by irrigation and, as the climate is favourable, the waters often become the breeding-places of Anophelines. A malaria survey was therefore carried out from 1926 to 1928 in the Rio Grande Valley in New Mexico [*R.A.E.*, B, xvii, 66] and Texas, the Pecos Valley, New Mexico, the Salt River Valley of Arizona and the Imperial Valley of California. The breeding-places comprise the drainage ditches that are dug to prevent water-logging of irrigated land that lacks sufficient natural drainage, the pools, ponds and swampy pastures formed by water seeping from irrigation ditches or intentionally directed to grassy lands where it forms wet pastures or meadows, and sometimes the irrigation canals themselves, especially where they are broad and sluggish and contain considerable aquatic vegetation. The water in the canals is usually swift and frequently changing in level, so that large numbers of Anophelines are seldom produced.

The Anophelines and their breeding-places and the prevalence of malaria in the localities surveyed are described. Malaria and the malaria danger seem to be largely confined to the Rio Grande Valley of Texas and New Mexico. The localities in this valley have certain characteristics in common. *Anopheles pseudopunctipennis*, Theo., occurs in all of them. *A. maculipennis*, Mg., is plentiful in New Mexico, and although it has not been found in Texas, it may be expected there at least in the cooler waters of the mountain regions. *A. quadrimaculatus*, Say, appears in effective numbers in the lower part of the valley in Texas. Benign tertian is the prevailing type of malaria, and its high incidence in this valley is remarkable, especially in the late summer months, a time when malignant tertian malaria is very common in the southern States at the same latitude. Much probably depends on the type of parasite commonly infecting carriers entering the valley. There is apparently nothing in the climate, elevation, or species of *Anopheles* of the region that can inhibit an outbreak of malignant tertian malaria.

In localities where the malaria rate is low, such general measures as the early recognition and treatment of the disease, and education in the manner of its transmission, the proper use of screens [*cf.* xvii, 116] and the value of early and thorough treatment of attacks may be

sufficient, especially if the discovery and treatment of carriers is also included, but in localities where the rate is high, particularly in closely populated centres situated near Anopheline breeding-places, anti-larval measures may be necessary [*cf.* xvii, 66]. Great variability was observed in the effectiveness of *Gambusia* against Anopheline larvae in the drains, and there is some evidence that these fish are more effective against *A. maculipennis* in southern New Mexico and Texas than against *A. pseudopunctipennis*. The breeding-places of the former appear to be more accessible to the minnows, whereas the mats of algae growing in the sun that are the preferred breeding-place of the latter may effectually protect the larvae against the fish. Moreover, in warmer climates *A. maculipennis* is more often found in the permanent waters of drains where *Gambusia* persists from year to year, whereas temporary rain and seepage pools usually harbour *A. pseudopunctipennis*. The wide distribution of *Gambusia* is, however, recommended, at least in the warmer climates.

Of the two species of Anopheline common in New Mexico, *A. maculipennis* would appear to visit houses more frequently or at least to be more prone to remain in them after feeding than *A. pseudopunctipennis*. Although the importance of *A. pseudopunctipennis* as a carrier of malaria cannot be entirely disregarded, owing to the fact that it is the principal carrier in Argentina, the evidence that *A. maculipennis* is the chief carrier in New Mexico is sufficiently strong to justify a concentrated attack on this species, provided that resources for combating all Anophelines are not available.

Boyd (M. F.) & Weathersbee (A. A.). **Studies on the Bionomics of North American Anophelines. V. Winter Activities of Anopheline Imagines in Coastal North Carolina (36° N. Lat.).**—*Amer. J. Hyg.*, ix, no. 3, pp. 682–694, 2 charts, 1 ref. Baltimore, Md., May 1929.

Further studies on the winter activities of adult Anophelines in North Carolina [*cf. R.A.E.*, B, xvi, 116] were carried out from 1st November 1927 to 1st May 1928. All the three species of Anophelines that occur in this locality were found during the winter, but *Anopheles punctipennis*, Say, was the most prevalent, *A. quadrimaculatus*, Say, being most abundant during the summer and *A. crucians*, Wied., being rare at all seasons.

The following is taken from the authors' summary: In cold weather the Anophelines seek shelter in large numbers in places unoccupied by persons or live stock, vacant houses and hollow trees being preferred. Their distribution and density in occupied shelters increase and decrease in direct relation to the temperature, whereas in unoccupied shelters their numbers vary inversely with the temperature. In extremely cold weather their occurrence is limited to unoccupied places. The ability to fly is suspended in intensely cold weather, and exposure to smoke produced no visible effect. In cold weather few freshly engorged mosquitos were found, but recently fed ones were observed in warm periods. Gravid females were relatively high in number in early winter and until oviposition began in January and February. Digestion of blood and development of the ovaries proceeds slowly throughout the winter, the females tending to postpone oviposition until the temperature is favourable.

CHAMBERLAIN (W. P.). **Twenty-five years of American Medical Activity on the Isthmus of Panama, 1904-1929.**—Med. 8vo., 74 pp., 23 pls., 2 charts, 3 maps, 6 pp. refs. Mount Hope, C.Z., Panama Canal Press, 1929.

This review of the work of the Health Department of the Panama Canal during the 25 years following 4th May 1904, on which date the United States took over the property from the French Canal Company, includes an account of the control of mosquito-borne diseases in the Canal area. The various phases of the anti-malarial campaign are outlined and discussed, the most permanent and satisfactory results being obtained by the obliteration by draining or filling of any standing water in which mosquito larvae may develop. The incidence of malaria was steadily reduced from 821 per 1,000 employees in 1906 to 31 in 1915 and 14 in 1917, since when it has varied between 11 and 31. The average for the last three years (1926–1928) has been 13 per 1,000.

FEEGRADE (E. S.). **A Note on the Anopheline Fauna of a small Tank throughout the Year.**—*Ind. Med. Gaz.*, lxiv, no. 5, pp. 251–252. Calcutta, May 1929.

Observations of an open-air tank at Rangoon during the year 1927 revealed the presence of *Anopheles fuliginosus*, Giles, which is the common malaria carrier in the plains of Burma, and was breeding along the grassy edges of the tank in January. Later, as the amount of water decreased and as red and green algae appeared on it, this species diminished in numbers until it disappeared altogether until early June, when the pH of the water fluctuated between 7·2 and 7·4. From June to October (the wet season) and from November to January this mosquito was present, but apparently produced no malaria in the neighbourhood, probably because the inhabitants of the district harboured no infection. *A. hyrcanus* var. *nigerrimus*, Giles, and *A. barbirostris*, Wulp, bred in the tank in the same season, but were not found after January; *A. vagus*, Dön., was found once only. During the dry season, the alkalinity of the water gradually increased, the highest figure (pH 7·8) being recorded in May.

FEEGRADE (E. S.). **Experiments with Isotex as a Larvicide.**—*Ind. Med. Gaz.*, lxiv, no. 5, p. 252. Calcutta, May 1929.

This proprietary preparation has been proved experimentally to be a powerful larvicide against both Anophelines and Culicines, but as it is fatal to fish, it is not considered suitable for use in anti-malarial measures.

FEEGRADE (E. S.). **Results of Experiments with Crude Oil Products of the Burma Oil Co., Ltd., Rangoon, as Larvicide.**—*Ind. Med. Gaz.*, lxiv, no. 5, p. 255. Calcutta, May 1929.

The results of laboratory experiments in oiling with certain proprietary preparations against larvae of *Aëdes argenteus*, Poir., are briefly discussed. Further observations with regard to the effect of temperature on their effectiveness are, however, necessary.

PHILLIPS (J. A. S.). **Malaria in Forest Areas.**—Cr. 8vo, 26 pp. Calcutta, Govt. India Cent. Pub. Br., 1929. Price *Annas* 2 or 3*d*.

In this pamphlet, which is published for the benefit of forest officers, the whole problem of malaria and its control in India is briefly outlined, particular reference being made to forest areas. In the past a plentiful and accessible water-supply was regarded as of primary importance in the selection of sites for camps, forest bungalows and forest guards' quarters, both for the convenience of the forest staff and for the village that must be established to provide supplies and labour. For this reason there is nearly always a stream in the vicinity of such buildings, and as little or no attention is paid to its condition, its edges are grass-grown and there are obstructions that impede its flow and render it sufficiently sluggish for the breeding of mosquitos. As hundreds of rest houses and inspection houses are dependent on wells for their water-supply, it is recommended that bungalows should be built at least half a mile from such streams (since this distance is usually regarded as the limit of flight of adult Anophelines) and obtain their water from wells. If villages are required nearer than half a mile from the camp, they should be similarly provided with wells, and in any case it is advisable not to allow the natives to use a stream, which may be contaminated above the site of the village. All jungle within half a mile of a bungalow should be cleared ; a few isolated trees may be left for shade but all brushwood and undergrowth should be completely removed. To prevent the jungle from growing up again, the area should be cultivated, but all tall crops and canal irrigation should be prohibited. With new constructions, if these two measures are properly carried out, other precautions should not be necessary. In the case of existing camps, the most important measure is jungle clearance and the filling up of unnecessary tanks and hollows likely to hold water sufficiently long to allow mosquito breeding. Within a radius of half a mile, all trees on both banks of a stream should be felled to prevent their leaves and branches falling in and causing obstructions, the banks and edges should be cleared of grass and growth of all kinds and isolated pools should be drained or treated with larvicides.

IRVINE (G. M.). **A Review of Malaria during 1928 in a minor Hill Station in the Punjab.**—*Ind. Med. Gaz.*, lxiv, no. 6, pp. 307–312, 2 tables. Calcutta, June 1929.

Investigation of malaria at Bakloh, a hill station in which the incidence of the disease was higher than would be expected from the characteristics of the locality, has shown that most of the cases were not infected locally.

The Anophelines collected during 1928 totalled 250. Of these, about three-quarters were *Anopheles willmori*, James, which was found from May to the end of September. *A. lindesayi*, Giles, was next in order of frequency, being taken in April–June. A few individuals of *A. maculipalpis*, Giles, were collected about mid-June, and one of *A. gigas*, Giles, in April. The chief breeding-places were small drainage channels. Local evidence is against *A. willmori* being an effective vector, and *A. maculipalpis* is considered responsible for most of the indigenous malaria.

Nieschulz (O.). **Zoologische Beiträge zum Surraproblem. xxiv. Einige weitere Uebertragungsversuche mit Mücken.** [Zoological Contributions to the Problem of Surra. xxiv. Some further Transmission Experiments with Mosquitos.]—*Centralbl. Bakt.* (1) Orig., cxi, no. 6–8, pp. 456–460, 2 refs. Jena, 25th April 1929.

In experiments in Java, one positive transmission of surra from horse to horse was obtained with *Armigeres obturbans*, Wlk. Results with *Aëdes argenteus*, Poir. (*Stegomyia fasciata*, F.) and *Culex whitmorei*, Giles, were all negative. The author had previously obtained transmission with *Anopheles fuliginosus*, Giles [*R.A.E.*, B, xvii, 49] and Kelser, contrary to the author, succeeded with *A. argenteus* [xvi, 87], so that several species of mosquitos can transmit surra mechanically. As, however, only 3 positive results have been recorded from over 3,200 individuals, mosquitos can scarcely play any part in the natural transmission of the disease, especially as they are usually able to complete their feed on a single animal.

Ottolenghi (D.) & Brotzu (G.). **Intorno all'eventuale azione di pasti eterologhi sullo sviluppo del parassita malarico nell'anofele.** [On the possible Effect of heterogeneous Meals on the Development of the Malarial Parasite in *Anopheles*.]—*Riv. Malariologia*, vii, no. 6, pp. 849–852. Rome, 1928. (With Summaries in Italian, p. 915, French, p. 916, English, p. 917, German, p. 918.)

Experiments show that malarial parasites [*Plasmodium vivax* and *P. falciparum*] develop normally in *Anopheles maculipennis*, Mg., though it may feed on various animals. This proves that migration of a mosquito from a house where it has acquired infection to a stable does not prevent the sexual development of the *Plasmodium* under suitable conditions of temperature and moisture. Experiments are being made to ascertain if continued feeding on animals frees the mosquitos from infection by eliminating the sporozoites in the course of repeated bites.

Walch (E. W.) & Bonne-Wepster (J.). **Note sur la conservation des larves des anophèles.**—*Riv. Malariologia*, vii, no. 6, pp. 866–867. Rome, 1928. (With Summaries in Italian, p. 915, French, p. 916, English, p. 917, German, p. 919.)

Berlese's fluid (4 parts glycerine, 10 parts chloral hydrate, 6 parts powdered gum arabic, 10 parts water) is recommended for preserving Anopheline larvae intended for postal transmission or laboratory mounting. When this cannot be used, the specimens may be sent in a 4 per cent. aqueous solution of formalin.

Rossi (G.). **Tre anni di lotta antimalarica a Maccarese durante l'effettuazione della "Bonifica integrale."** [Three Years of anti-malarial Work in the Maccarese Area, during a successful radical Campaign against Malaria.—*Riv. Malariologia*, viii, no. 1, pp. 1–27, 5 figs., 4 pls., 10 refs. Rome, 1929. (With Summaries in Italian, p. 104, French, p. 106, English, p. 108, German, p. 110.)

This is an account of work done in the course of a successful anti-malarial campaign in an area of about 14,000 acres in the Tiber delta. Up to 1925 this land was marshy, uncultivated and almost uninhabitable owing to malaria. In 3 years the permanent population increased from

50 to 1,800, with 1,000 day labourers coming from outside. The hydraulic, agrarian and building works were co-ordinated with an intensive anti-malarial campaign directed by the author. Screening proved of practical value; the dwellings were cleared of mosquitos by spraying, supplemented by systematic collections; oiling was carried out, and large areas of water were cleared of vegetation and stocked with *Gambusia*.

SWELLENGREBEL (N. H.) & DOORNBOS (W. H.). **L'influence de la substance diluante sur l'action larvicide du "vert de Paris."**—*Riv. Malariologia*, viii, no. 1, pp. 34–37. Rome, 1929. (With Summaries in Italian, p. 105, French, p. 107, English, p. 109, German, p. 111.)

Fluctuations in the effectiveness against Anopheline larvae of Paris green mixed with ashes are due to variations in the weight of the ashes. When they are too light, they remain on the surface of the water, and the larvae ingest large quantities with little or no poison. Counts of the granules of Paris green made by means of a slide show that they remain on the surface, in decreasing quantities, 24, 48 and 72 hours after dusting, while the ashes disappear after 24 hours. This explains why the larvae surviving after 24 hours subsequently die. Trass (a kind of volcanic earth) has been found to be sufficiently heavy to avoid interfering with larvicidal action during the first few hours after dusting, and is readily applied by a dusting apparatus. A larval mortality of 99·9 per cent. was attained in 24–48 hours with dust containing 1 per cent. of Paris green, about 50 per cent. of the larvae present being young ones. The weight of ashes used has varied from 10 to 14 kgs. per 20 litres, whereas the weight of trass is 19 kgs., and 4 litres per 100 sq. metres are used instead of about 8 litres of ashes, resulting in the application of 0·44 gm. Paris green per square metre. Satisfactory results have not been obtained with powdered cement in spite of its apparent similarity to trass.

NERI (F.). **Sulla epidemia di dengue in Grecia nel 1928. Note epidemiologiche.** [On the Epidemic of Dengue in Greece in 1928. Epidemiological Notes.]—*Ann. Igiene*, xxxix, no. 2, pp. 93–101. Rome, February 1929.

Aëdes argenteus, Poir. (*Stegomyia calopus*, Mg.) was extremely abundant in the Athens-Piraeus area at the time of the outbreak of dengue in 1928 and was four times as numerous as *Culex* and *Phlebotomus* together. Only 5 per cent. of the examples taken were males.

The predominance of *A. argenteus* and the absence in 1928 of *Culex fatigans*, Wied., which is considered to be a possible vector of the disease, indicate that the former was perhaps alone responsible for its transmission.

SWELLENGREBEL (N. H.), DE BUCK (A.) & SCHOUTE (E.). **Een orienteerende analyse van de Anophelesfauna onzer noordelijke provinciën.** [An indicative Analysis of the Anopheline Fauna of the northern Provinces of Holland.]—*Versl. Meded. Volksgezondheid*, 1929, no. 1, reprint 11 pp., 2 maps, 9 refs. [Amsterdam] 1929.

Further studies on *Anopheles maculipennis*, Mg., over a larger area in Holland tend to confirm previous observations [*R.A.E.*, B, xv, 21,

145 ; xvi, 242] that the absence of malaria in some localities is due to differences in the type of mosquito present. There is no difference in the infectibility of the two types by the tertian parasite [*Plasmodium vivax*], but, though the differences in their mode of hibernation do not affect chances of infection in summer, the large type is less inclined to attack man, and the Anopheline population is less dense in areas where there are many large individuals. Both North Holland and Friesland may be divided into three regions in which either the large or small type occurs alone or both types occur together.

A preference for animal quarters has been adduced in explaining the absence of malaria in the presence of Anophelines, but in the areas examined there was no preference for animal quarters over human dwellings. In fact, mosquitos were both absolutely and relatively less numerous in dwellings in the malarial districts. This was to be expected, because the large type mosquitos (which hibernate completely) use human dwellings purely as " shelters " and do not feed there.

PEUS (F.). **Die Stechmückenfauna des südwestlichen Gebietes von Gross-Berlin.** [The Mosquito Fauna of the south-western Area of Greater Berlin.]—*Z. Desinfektion*, xxi, no. 3 (Ausgabe A), pp. 67–72, 1 map. Dresden, March 1929.

The species recorded in this survey include *Anopheles maculipennis*, Mg., *A. bifurcatus*, L., and a number of Culicines, of which *Aëdes vexans*, Mg., *A. dorsalis*, Mg., *Culex pipiens*, L., and *Theobaldia annulata*, Schr., are stated to cause annoyance.

BUCHMANN (W.). **Untersuchungen über die physiologische Wirkung von Pyrethrum-Insektenpulver auf Fliegenlarven.** [Investigations on the physiological Effect of Pyrethrum Insect Powder on Fly Larvae.]—*Z. Desinfektion*, xxi, no. 3 (Ausgabe A), pp. 72–76, 2 figs., 4 refs. Dresden, March 1929.

An account is given of investigations on the action of the active principle in pyrethrum on the larvae of *Musca domestica*, L., and *Stomoxys calcitrans*, L. The pyrethrines [*R.A.E.*, A, xiii, 298, 299 ; xvi, 11], must be regarded primarily as nerve poisons, and the fact that all parts of the body of the larva are not affected in a uniform manner must be connected with the distribution of the nerves in the body.

EDDY (C. O.). **House Fly Fumigation Experiments with Calcium Cyanide.**—*Bull. S. Carolina Agric. Expt. Sta.*, no. 256, 48 pp. 15 figs., 7 refs. Clemson College, S.C., April 1929.

Further experiments were carried out with calcium cyanide fumigation against the house-fly [*Musca domestica*, L.] in order to test the recommendations already made [*R.A.E.*, B, xv, 147], and to obtain more definite information on the dosage of calcium cyanide, the concentration of hydrocyanic acid gas, the time of exposure and the toxicity to flies, and the relationship between the dispersion of the calcium cyanide and the concentration of the gas secured. Successive lots of flies were confined in cages at three different heights in the fumigation room and exposed to hydrocyanic acid gas derived from dosages of calcium cyanide varying from $\frac{1}{8}$ oz. to 16 oz. per 1,000 cu. ft. One cage was removed from each position in the room and the mortality noted at time intervals so adjusted that it was possible to determine the

relationship of exposure and dosage. The concentration of the gas at each level was determined every time cages were removed [*R.A.E.*, A, xvii, 449], an operation that was carried out more frequently early in the experiments when the mortality of the flies and the concentration of the gas were changing more rapidly.

No consistent difference was noticed in the concentration of the gas at different elevations, and the fact that most frequently the highest mortality took place in the top cages and the lowest in the bottom ones appeared to be correlated with temperature. The information on the correlation of concentration and dosage has already been dealt with [A, xvii, 450]. Toxicity depended on concentration of the gas and time of exposure. Initial concentrations that produced a high mortality during the first few examinations gave satisfactory control, whereas a dosage or concentration of gas that gave a low mortality during the first two or three examinations usually did not gives satisfactory control even with longer exposures. The results indicate that when flies are rather uniformly distributed throughout a large room with a small amount of leakage, a dosage of $\frac{3}{8}$ oz. gives commercial control (90–100 per cent. mortality) with an exposure of at least $5\frac{1}{2}$ hours. The dosage of calcium cyanide cannot be reduced below $\frac{3}{8}$ oz., even when fumigation is uninterrupted for 24 hours. The amount of calcium cyanide necessary to produce a mortality of 98–100 per cent. was nearly twice that required for commercial control.

MARTINEZ (M.). **La mosca domestica en la ciudad de Mexico.** [The House Fly in the City of Mexico.]—*Mem. Soc. "Ant. Alzate,"* xlviii, no. 7–12, pp. 391–418, 8 pls., 19 refs. Mexico, 1928.

This somewhat popular account of *Musca domestica*, L., in Mexico, where it is found throughout the year, includes a description of the morphology of the fly and the usual remedies adopted against it. The larva normally hatches in 24 hours and pupates after 4–5 days, the pupal stage lasting 5–6 days and the life of the adult 20–30.

SPANN (—). [**The Destruction of the Larva of** *Hypoderma bovis* **by sealing the Orifice of the Tumour.**]—*Münch. tierärztl. Wschr.*, 7th November 1928. (Abstract in *La Clinica vet.*, lii, no. 3, p. 164. Milan, March 1929.)

Experiments were made to test the possibility of asphyxiating the larvae of *Hypoderma bovis*, DeG., in the backs of cattle by applying collodion, either alone or mixed with acetone, to the orifices of the warbles. A triple application to each tumour proved successful, but in view of the time required, a trial was made with a paste used in cardboard manufacture. This was not effective, and it is concluded that the method of sealing the orifice is valueless in practice.

WALKER (C. R.). *Cephenomyia* **sp. killing Deer.**—*Science*, lxix, no. 1799, pp. 646–647, 2 refs. New York, N.Y., 21st June 1929.

Cephenomyia sp. is recorded from Colorado as infesting deer in the early spring and causing the death of large numbers. As many as 54 larvae in all stages of growth were taken from the head of one animal. The present rate of destruction of the deer by this Oestrid makes the problem of game conservation in this region a serious one.

Rawson (G. W.). **Insects and Insect-borne Diseases of Animals.**—*J. Amer. Vet. Med. Ass.*, lxxiv (N.S. xxvii), no. 7, pp. 1027–1039, 4 figs., 20 refs. Detroit, Mich., June 1929.

This is a brief review of some of the literature on insects and ticks that transmit diseases of animals and birds either mechanically or as intermediate hosts, including insects that act as intermediate hosts for parasitic worms.

Jones (M. F.). *Aphodius granarius* (**Coleoptera**), **an Intermediate Host for** *Hymenolepis carioca* (**Cestoda**).—*J. Agric. Res.*, xxxviii, no. 11, pp. 629–632, 1 fig., 2 refs. Washington, D.C., 1st June 1929.

This paper supplies detailed evidence that the dung beetle, *Aphodius granarius*, L., is an intermediate host of *Hymenolepis carioca*, a Cestode parasite of fowls [*cf. R.A.E.*, A, xvii, 87]. Five birds were fed on 21 beetles that had eaten gravid segments of the Cestode. Post-mortem examinations of these, about a month later, showed four of them to contain mature Cestodes. Cysticercoids were present in the seven beetles that were dissected before being given to the birds. The period of development probably varies with the temperature ; 18 days was the minimum time, after the beetles were offered Cestode material, in which cysts were observed on dissection and later proved to be infective.

The control methods advocated consist of prompt and thorough disposal of excreta and keeping yards free from unnecessary objects that serve as temporary hiding places for the beetles. If screening is adopted, the wire mesh should not be more than about 1·5 mm.

Cutright (C. R.). **The Feather Mite in Ohio.**—*Bi-m. Bull. Ohio Agric. Expt. Sta.*, no. 138, pp. 100–102, 1 fig. Wooster, Ohio, May-June 1929.

An account is given of an infestation of poultry in Ohio by *Liponyssus sylviarum*, C. & F. (feather mite) during the winter of 1929, a shorter report of which has already been noticed [*R.A.E.*, B, xvii, 163]. Since it is doubtful whether complete eradication could be obtained by the measures recommended, it is suggested that when weather conditions permit it would be advisable to treat the birds individually by dipping or dusting [*R.A.E.*, B, xiv, 214]. A mixture of 20 per cent. creosote and 80 per cent. kerosene may be substituted for carbolineum for painting the chicken houses, etc. Nesting materials should be kept treated with sulphur dusts.

Young (W. J.). **The Eradication of Sheep Scab.**—*Vet. J.*, lxxxv, no. 6, pp. 241–249, 7 figs. London, June 1929.

In spite of the Sheep Scab Order of 1928 and the Amendment Order of 1928, and of an educational campaign begun under the auspices of the Ministry of Agriculture, there are many factors that render difficult the complete eradication of the disease in Great Britain, chief of which, perhaps, is lethargy and carelessness on the part of sheep breeders. A brief account is given of the sheep scab mite, *Psoroptes ovis*, Hering, the life-cycle of which under ordinary conditions requires about 10 days. The mites may live for a month or six weeks after removal from the host, and although the eggs are generally supposed to hatch in

a few days, there are records of hatching two and even four weeks after removal from sheep. The Sheep Scab Order prescribes double dipping for sheep, the second dipping to take place from the 8th to the 14th day after the first, as there is no known dip that will destroy the eggs without injuring the skin of the sheep. Suggestions are made for further research that is required on dips. It is thought that local authorities might provide proper dipping places and charge for their use.

FREUND (L.) & STOLZ (A.). **Beiträge zur Biologie der Schaflausfliege,** *Melophagus ovinus.* [Contributions to the Biology of the Sheep Ked, *M. ovinus.*]—*Prager Arch. Tiermed.*, viii, A, pp. 93–106, 8 refs. Prague, 1928.

Observations are recorded on the habits and blood-circulation of *Melophagus ovinus*, L., and a detailed account is given of its method of sucking blood. The bionomics and development of the early stages are discussed, much of the information being taken from the literature.

FREUND (L.). **Läusestudie ix. Die haarige Rinderlaus,** *Solenopotes capillatus* **Enderl.** [Louse Study ix. The Cattle Louse, *S. capillatus.*]—*Prager Arch. Tiermed.*, vii, A, pp. 215–227, 9 figs., 13 refs. Prague, 1927. [Recd. 1929.]

A list is given of existing records of *Solenopotes capillatus*, End., from Europe and North America. Enderlein's description of the genus is reproduced, and a further description of the species is given. The author compares his results relating to the character of the egg and larva with those published by Bishopp [*R.A.E.*, B, ix, 203].

FREUND (L.). **Weitere Unterschiede zwischen Kopf- und Kleiderlaus.** [Further Differences between *Pediculus capitis* and *P. humanus.*]—*Med. Klinik*, 1927, no. 16, reprint 3 pp., 2 figs. Berlin, 1927. [Recd. 1929.]

Differences in the male genitalia between *Pediculus capitis*, DeG., and *P. humanus*, L. (*corporis*, DeG.) are described.

WATERSTON (J.). **On a Chalcidoid Parasite bred from a Flea Larva.**—*Parasitology*, xxi, no. 1–2, pp. 103–106, 1 fig. Cambridge, May 1929.

The Miscogasterid, *Bairamlia fuscipes*, gen. et sp. n., is described from a small series bred from cocoons of *Ceratophyllus wickhami*, Baker, taken in a nest of the American grey squirrel, *Sciurus carolinensis*, in Buckinghamshire. This flea is now common in the London district.

MACGREGOR (M. E.). **The Significance of the pH in the Development of Mosquito Larvae.**—*Parasitology*, xxi, no. 1–2, pp. 132–157, 1 fig., 42 refs. Cambridge, May 1929.

This paper forms the continuation of a previous study [*R.A.E.*, B, x, 25] on the influence of hydrogen-ion concentration in the development of mosquito larvae. A short summary is given of the records subsequently published by other investigators. In an attempt to demonstrate the actual significance of the pH in mosquito breeding-places, it is shown by means of experiments with *Aëdes argenteus*, Poir.,

in which the interacting factors were gradually eliminated, that although the larvae are adversely affected by a change in the pH value of the normal environment, this does not hold good under bacteriologically sterile conditions, and that consequently the acid or alkaline reaction of the medium has no direct effect upon the development of the larva within ordinary limits. The influence of the hydrogen-ion concentration is, however, shown to be of unquestionable importance, since, under natural conditions, it indicates the favourable or unfavourable association of chemical and biological factors in the breeding-places upon which the development of the larvae depends.

The pH index, therefore, though not an infallible guide, provides in most cases a reliable indication as to whether the necessary combination of chemical and biological factors in any given water are such that they will permit the development of the larva of a particular species. Some species find their optimum conditions for development in waters that are acid, others in those that are alkaline. Experiments in altering the pH of such waters resulted in some cases in bringing about a complete change in the biological group associations, which frequently means the acquired abnormal dominance of factors unfavourable to larvae of a particular species. In rare instances larvae that are in general acidophile may be found in waters showing alkalinity, but in most instances in various localities, the larvae of a given species actually show a restriction to waters exhibiting a pH index within a definite short range.

A new technique is described for the production of a high percentage of successful cultures of larvae and pupae of *A. argenteus* under bacteriologically sterile conditions by disinfecting the ova. Experiments were carried out with various artificial materials employed as larval food, of which bread proved the most favourable. It was observed that the larvae will tolerate a high degree of turbidity due to the addition of an excessive amount of bread so long as the reaction is alkaline, but frequently die rapidly as soon as any marked degree of acidity develops from bacterial fermentation. What would otherwise have been an excess of bread had no adverse effect upon larvae in sterile culture tubes. It is concluded that this applies equally to the food-supply under natural conditions.

A phase of suspended development is frequently exhibited by mosquito larvae of many species, particularly those that breed in tree-holes. Investigations suggest that this is due to the temporary or complete disappearance of micro-organisms on which the conversion of the organic materials of the environment to a suitable larval diet depends. The disappearance of these micro-organisms, which is brought about in the laboratory by alteration of the pH index, is probably induced in nature by cold.

MARSHALL (J. F.) & STALEY (J.). **A newly observed Reaction of certain Species of Mosquitoes to the Bites of Larval Hydrachnids. Preliminary Contribution.**—*Parasitology*, xxi, no. 1–2, pp. 158–160, 3 figs., 1 ref. Cambridge, May 1929.

Examination of a number of females of *Aëdes cinereus*, Mg., and of one of *A. annulipes*, Mg., infested with larval mites, collected near Birmingham on 31st July and 1st August, disclosed the presence of dark serpentiform tubular processes originating at the points where the mites were attached to the host and penetrating within the abdomen.

Similar processes unaccompanied by mites were also present, presumably caused by mites subsequently detached. It is suggested that these processes, the occurrence of which is recorded apparently for the first time and which are described in detail, are the product of a protective reaction occurring in the mosquito to oppose some kind of infective invasion. The mites have been identified as larval Hydrachnids, a similar form having been figured by Nalepa as the larva of *Lebertia tauinsignita*, Lebert.

PAPERS NOTICED BY TITLE ONLY.

SHANNON (R. C.), DAVIS (N. C.) & DEL PONTE (E.). **La distribución del** *Anopheles pseudopunctipennis* **y su relación con el paludismo en la Argentina.** [The Distribution and Relation to Malaria of *A. pseudopunctipennis* in Argentina.]—*An. Dep. nac. Hig.*, xxxiii, pp. 65–88, 12 figs., 3 maps, 29 refs. Buenos Aires, 1927. [See *R.A.E.*, B, xvi, 145.]

SHANNON (R.C.) & DAVIS (N. C.). **Condiciones de reproducción de** *Anopheles pseudopunctipennis* **en la provincia de Tucumán durante la estación seca.** [The Reproduction of *A. pseudopunctipennis* in the Argentine Province of Tucumán during the dry Season.]—*An. Dep. nac. Hig.*, xxxiii, pp. 142–155, 5 figs. Buenos Aires, 1927. (With Summaries in French, English and German.) [See *R.A.E.*, B, xvi, 145.]

WIGGLESWORTH (V. B.). **The early Stages of some West African Mosquitos.**—*Bull. Ent. Res.*, xx, pt. 1, pp. 59–68, 7 figs. London, May 1929.

SAMTLEBEN (B.). **Anatomie und Histologie der Abdominal- und Thoraxmuskulatur von Stechmückenlarven.** [Anatomy and Histology of the abdominal and thoracic Muscles of Mosquito Larvae.]—*Z. wiss. Zool.*, cxxxiv, pp. 180–269, 18 figs., 31 refs. Leipzig, June 1929.

GRASSÉ (P.) & DE BOISSEZON (P.). *Turchiniella culicis* **n.g., n. sp. Infusoire parasite de l'hémocoele d'un** *Culex* **adulte.**—*Bull. Soc. zool. Fr.*, liv, no. 3, pp. 187–191, 6 figs., 4 refs. Paris, 15th July 1929.

MEILHAN (J.). **Contribution à l'étude des** *Culicoides* **de la région bordelaise.**—Thesis Univ. Bordeaux, roy. 8vo, 50 pp., 11 figs., 6 pp. refs. Bordeaux, 1927. [Recd. 1929.]

KRÖBER (O.). **Ueber einige kleinere Gattungen der südamerikanischen Tabanini.** [Notes on some minor Genera of South American Tabanini (with key to 13 genera and descriptions of 6 new species).] —*Zool. Anz.*, lxxxiii, no. 1–4, pp. 47–63, 115–137, 13 figs. Leipzig, June–July 1929.

RINGDAHL (O.). **Bestämningstabeller till svenska muscidsläkten. 1 avd. Muscinae.** [Keys to Swedish Muscid Genera. Pt. I. Muscinae.]—*Ent. Tidskr.*, l, no. 1, pp. 8–13. Stockholm, 1929.

KEMPER (H.). **Beobachtungen über den Stech- und Saugakt der Bettwanze und seine Wirkung auf die menschliche Haut.** [Observations on the Piercing and Sucking of the Bed-bug [*Cimex lectularius*, L.] and their Effect on the human Skin.]—*Z. Desinfektion*, xxi, no. 3 (Ausgabe A), pp. 61–67, 3 diagr., 13 refs. Dresden, March 1929.

WATERSTON (J.). **On a new Louse** [*Ancistroplax crocidurae*, gen. et sp. n.] **from a Ceylonese Shrew** [*Crocidura horsfieldi*].—*Parasitology*, xxi, no. 1–2, pp. 161–163, 1 fig. Cambridge, May 1929.

The Cattle Tick Pest and Methods for its Eradication.—*Pamph. Council Sci. Ind. Res. Australia*, no. 12, 23 pp. Melbourne, 1929.

Most of the information contained in this pamphlet on *Boophilus annulatus australis*, Fuller, has already been noticed [*R.A.E.*, B, vii, 186; xvi, 194]. Revised formulae for arsenical dips are given, and the desirability of adopting uniform, efficacious methods in the cleansing of cattle for eradication of the tick is emphasised. To obtain this uniformity, it is first essential to determine, under natural conditions, the best interval between dippings and the optimum composition of the dip by observing the time required to eradicate all ticks in a suitable locality, where the cattle can be isolated. It has been agreed to test the effect of dips containing 8 lb. arsenious oxide to 400 gals. at intervals of 14 days and 6½ lb. every 18 days.

Hoare (C. A.). **Studies on *Trypanosoma grayi*. 2. Experimental Transmission to the Crocodile.**—*Trans. R. Soc. Trop. Med. & Hyg.*, xxiii, no. 1, pp. 39–56, 4 pls., 25 refs. London, 25th June 1929.

The following is taken from the author's summary :—

The experiments described in this paper, which were carried out in Uganda, prove the identity of *Trypanosoma grayi*, the parasite of *Glossina palpalis*, R.-D., with the trypanosome of the crocodile, *T. kochi*. The infective forms of *T. grayi* are found in the hind-gut of the fly, and infection of the crocodile takes place by contamination through the mouth. The trypanosomes experimentally introduced into the crocodile were recovered by means of uninfected flies, in the intestines of which they gave rise to typical *T. grayi*. *T. grayi* was experimentally carried through its entire life-cycle in the vertebrate and invertebrate hosts, the incubation period in the crocodile being 4 days. Monitors (*Varanus*) in Entebbe do not harbour trypanosomes, and all attempts to infect them with *T. grayi* from *G. palpalis* failed.

Fletcher (W.), Lesslar (J. E.) & Lewthwaite (R.). **The Aetiology of the Tsutsugamushi Disease and Tropical Typhus in the Federated Malay States. Part II.**—*Trans. R. Soc. Trop. Med. & Hyg.*, xxiii, no. 1, pp. 57–70, 2 charts, 16 refs. London, 25th June 1929.

The following is largely taken from the authors' summary :—

Tropical typhus bears a close clinical resemblance to mild typhus fever, but it does not spread from man to man, it does not give rise to epidemics, and lice (*Pediculus*) are not the vectors of the virus. In the Federated Malay States there are two kinds of tropical typhus: the first is a disease of towns, the majority of the persons affected being indoor workers, particularly those who deal with foodstuffs; the second is essentially a disease of the open country, affecting outdoor workers. The distribution of the latter is sporadic, and outbreaks occur particularly in areas cleared of jungle that are allowed to grow up in weeds and scrub; for this reason the name "scrub typhus" is proposed for this form. An account is given of an outbreak of 61 cases of scrub typhus on an oil palm estate, where cases of tsutsugamushi disease had occurred among the European staff. The symptoms of the two diseases are much alike, but there are various points of distinction. It is suggested that they have a similar aetiology and that scrub typhus, like tsutsugamushi disease, is carried by Trombiculids.

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HINDLE (E.) & FENG LAN CHOW. **Experiments with Malaria and Mosquitoes in Shantung, China: with a Note on the Value of Local Species of Fish for the Destruction of Mosquito Larvae.**— *Trans. R. Soc. Trop. Med. & Hyg.*, xxiii, no. 1, pp. 71–80, 26 refs. London, 25th June 1929.

In spite of the importance of malaria in China, no observations appear to have been made regarding the species of *Anopheles* concerned in its transmission. During 1926 experiments were carried out in Tsinan, Shantung Province, where benign tertian seems to be the only endemic type of malaria. The presence of numerous springs and the marshy land around a lake within the city walls would seem to furnish conditions favourable for the spread of the disease, but actually endemic malaria is not at all common in the town. Only two species of *Anopheles* were found in Tsinan, *A. hyrcanus* var. *sinensis*, Wied., and *A.* (*Myzomyia*) *pattoni*, Chr. *A. lindesayi*, Giles, was bred from larvae collected in mountain pools about 40 miles to the south, but it was not possible to carry out transmission experiments with this species.

The mosquitos hibernate during the winter months and first begin to appear in May. Owing to the dryness of the spring and early summer, there are comparatively few breeding-places until July and August, when heavy rains result in the formation of numerous temporary streams and pools. Early in September, the number of mosquitos reaches its maximum, and larvae and pupae of Anophelines and Culicines are abundant in any suitable waters. They would be more prevalent but for the presence of small fish that abound in the lake and travel up many of the temporary streams. Moreover, the common goldfish generally kept in ornamental pools in gardens prevent the occurrence of mosquitos in what would otherwise be very favourable breeding-places.

All mosquitos used in the experiments were reared in the laboratory from larvae and pupae collected from pools and small streams around Tsinan. After emergence, the adults were put in feeding boxes resembling those used in transmission experiments with *Phlebotomus* [*R.A.E.*, B, xv, 177]. After feeding on an untreated case of tertian malaria in which the blood contained large numbers of gametocytes, the gorged mosquitos were kept in moist earthenware pots covered with mosquito netting and fed at intervals (until ready for dissection) on a normal individual or a rabbit. The pots were kept in an incubator at 25° C. [77° F.] in a saturated atmosphere. Most of the mosquitos were left sufficiently long to allow time for the development of the sporozoite stage and infection of the salivary glands.

A. hyrcanus var. *sinensis* was by far the commoner species, but the adults were rarely seen inside any houses or buildings. It feeds readily in captivity and seems to be more hardy than *A. pattoni*, as very few of the individuals died before the end of the experiments. Only 20 out of 121 individuals became infected, giving a percentage rate of about 16·5. *A. pattoni* is not so abundant and is more liable to be attacked by fish, as it breeds in small sluggish streams. Out of eleven individuals, nine became infected (eight in the salivary glands), giving an infection rate of approximately 82 per cent. *A. hyrcanus* var. *sinensis*, being the larger species, ingests a larger quantity of blood, and the difference in the results cannot therefore be attributed to variations in the number of gametocytes taken in by the mosquito. The results of the experiments indicate that both species are capable

of transmitting benign tertian malaria in China, but that *A. pattoni* is a more favourable host of *Plasmodium vivax* than *A. hyrcanus* var. *sinensis*. The latter is a much more conspicuous species than the former, which may therefore have been overlooked in places where malaria has been attributed to the presence of *A. hyrcanus* var. *sinensis* alone. The observations of other authors on the infection of the latter with malaria are briefly reviewed.

Adler (S.) & Theodor (O.). **The Distribution of Sandflies and Leishmaniasis in Palestine, Syria and Mesopotamia.**—*Ann. Trop. Med. Parasit.*, xxiii, no. 2, pp. 269–306, 1 pl., 9 figs., 2 maps, 29 refs. Liverpool, 27th June 1929.

An account is given of a survey carried out from May to October 1928 of sandflies in Mesopotamia, Syria and Transjordania in relation to the distribution of leishmaniasis, together with a study of sandflies in Palestine continued since the summer of 1924. Although incomplete, this survey, which includes the extremes and all gradations of topographical and climatic variations within the large area examined, indicates the salient features in the distribution of the more important species. Cutaneous leishmaniasis (oriental sore), apart from the large endemic centres in Baghdad, Mosul and Aleppo, is distributed irregularly throughout the whole area examined, whereas visceral leishmaniasis has been recorded only from Lebanon. Cutaneous leishmaniasis in dogs has been recorded only from Baghdad and Aleppo, and no evidence of visceral canine leishmaniasis has been observed.

Diagnostic characters for both sexes are given in respect of the sandflies of the erect-haired group recorded, *viz.*, *Phlebotomus papatasii*, Scop., *P. sergenti*, Parrot, *P. major*, Ann., and *P. chinensis*, Newst., which is considered specifically distinct from *P. major*. The species of the *minutus* group recorded are *P. minutus*, Rond., *P. minutus* var. *niger*, Ann., *P. africanus*, Newst., *P. palestinensis*, Adl. & Theo., *P. baghdadis*, sp. n., *P. iraqi*, sp. n., and *Phlebotomus* sp. near *clydei*, Sinton. A key is given to the females of the species of the *minutus* group; the two new ones are both described from Mesopotamia.

Parasites of the sandflies observed other than *Leishmania* included: a fungus destroying the eggs found in *P. papatasii* and *P. sergenti* in Palestine; Nematodes found in the haemocoele and ovaries of the same two species; and an oocyst, probably *Hepatozoon* sp. [*R.A.E.*, B, xiii, 175]. A *Crithidia* was found in the midgut, cardia and stomach of *P. baghdadis*, and the fact that one sandfly showed flagellates in the cardia and not in the stomach and hindgut indicates that transmission to the vertebrate host is by the bite of the insect, although infection by ingestion of infected sandflies is also to be expected. The vertebrate host is probably a gecko.

The relation of sandflies of the erect-haired group to visceral leishmaniasis is discussed, though no definite conclusion can at present be drawn, together with their distribution in relation to oriental sore. *P. chinensis* was found in Palestine and Syria. The epidemiological in addition to experimental evidence show that *P. papatasii* and *P. sergenti* are carriers of oriental sore. In Baghdad *P. sergenti* is the main carrier and in Jericho and Bar Elias *P. papatasii* is the sole carrier, whereas in Aleppo both species probably transmit the disease. There are localities free from oriental sore in which *P. sergenti* and *P.*

papatasii occur. The peculiarities of the distribution of oriental sore depend on the variations in infectivity of different strains of *Leishmania tropica* for the sandfly vector [*R.A.E.*, B, xvii, 149].

Since the incubation period varies from 2 weeks to 3 years and the early stages of oriental sore are often overlooked, a determination of the season of maximum infection rate is necessary in order to establish the period when the disease is most frequently transmitted in nature. The observation of the distribution of flagellates of *Leishmania* in sandflies, without which the determination of the infection rate is useless, is discussed. The species of Herpetomonad flagellates found to adopt an anterior position in a wild sandfly can best be identified as *Leishmania* by inoculation into man. Although it was not possible to investigate seasonal variation of the infection rate in endemic foci of the type found in Palestine, where only a few sporadic cases occur annually, the infection rate in Jericho was found in 1925 to be about 1 per 1,000 in *P. papatasii*, and in Baghdad 2 out of 683 wild *P. sergenti* dissected were found to be infected. A 6 per cent. infection rate was found among sandflies by Wenyon in 1912 in Aleppo, where oriental sore is now stated to be on the decline. No *Leishmania* was found among 690 sandflies dissected there during the present survey.

COLAS-BELCOUR (J.). **Contribution à l'étude du développement et de la biologie des formes larvaires des phlébotomes.**—Thesis. [Univ. Paris], 8vo, 92 pp., 3 pls., 8 figs., 7 pp. refs. Bayeux, 1928.

This anatomical and biological study of the immature stages of three Tunisian sandflies, *Phlebotomus papatasii*, Scop., *P. perniciosus*, Newst., and *P. parroti*, Adler and Theodor, shows that marked morphological differences exist between the eggs and newly hatched larvae of all three species. The differences between the older larvae and pupae of *P. papatasii* and *P. perniciosus* are smaller, but those between these two species and *P. parroti*, which belongs to the group of *P. minutus*, Rond., persist up to the last stages, corroborating the distinction already established between these two groups from a systematic and biological point of view. Keys are given to the eggs, first and fourth stage larvae and pupae of all three species.

The author goes on to discuss the effects of various conditions, such as humidity, temperature, light, etc., on the development of these sandflies, including notes on the observations of other workers. The phenomenon of cyclic asthenobiosis or spontaneous torpor observed by Roubaud [*R.A.E.*, B, xvi, 171, 183, 239, etc.] is considered a possible explanation of the sudden appearance of sandflies at irregular periods, and it is suggested that they are liable to appear at any season of the year. The various methods of discovering the immature stages in their natural habitats are reviewed. In spite of the diversity of the oviposition sites chosen, all possess three common factors, humidity, obscurity and nitrogenous food. Wherever these three conditions exist, occasional oviposition may occur, and accidental oviposition is possible even in the absence of nutritive substances. Attempts to control the larvae are based on the suppression of these favourable conditions by such means as the demolition of old walls, deforestation, stopping up cracks in the soil, and the removal of surface vegetation in the neighbourhood of dwellings. Crevices likely to shelter the larvae may be treated with lime, kerosene or tar. Various measures

hitherto employed against the adults are discussed, but none has proved entirely satisfactory. Fumigants, sprays and repellents have only a transient effect. Electric ventilation is recommended as an accessory measure to the use of nets, which must be of a much finer mesh than those required for mosquitos. The preference for animal as opposed to human blood recorded in respect of certain species of *Phlebotomus* in other countries has not been observed in Tunisia.

Noguchi (H.), Shannon (R. C.), Tilden (E. B.) & Tyler (J. R.). **Etiology of Oroya Fever. XIV. The Insect Vectors of Carrión's Disease.**—*J. Exp. Med.*, xlix, no. 6, pp. 993–1008, 3 pls., 20 refs. New York, 1st June 1929.

A preliminary account of these investigations on the transmission of verruga (Oroya fever, Carrión's disease) by sandflies (*Phlebotomus*) has already been noticed [*R.A.E.*, B, xvii, 155]. Sandflies and various other Arthropods were collected in the verruga zone of the Rimac valley, Peru, and were sent alive to New York in sterile tubes, either dry or containing a piece of absorbent cotton-wool moistened with sterile citrate solution. In New York, the method of determining the presence or absence of *Bartonella bacilliformis*, the causal organism of the disease, in the various Arthropods, was to inject a saline suspension of the crushed bodies intradermally, sometimes also intravenously, into monkeys (*Macacus rhesus*) and to make cultures of the blood at intervals of one to four weeks later. The only positive results were those with sandflies. A list is given of other blood-sucking Arthropods with which negative results were obtained, including mites of several genera from lizards or geckos. The blood of two geckos, tested in the same way, gave negative results. Townsend considered these reptiles to be reservoirs of verruga [*R.A.E.*, B, ii, 144, 186 ; xv, 159].

The males of the three species of *Phlebotomus* found in the Rimac valley, *viz.*, *P. verrucarum*, Towns., *P. noguchii*, Shannon, sp. n., and *P. peruensis*, Shannon, sp. n., are briefly described, and a key to them is given. The females of *P. peruensis* can easily be distinguished from those of the other two species ; no definite morphological characters for separating the females of *P. noguchii* from those of *P. verrucarum* have been discovered, but the latter species is normally smaller than the former, and since all males found in houses were *P. verrucarum*, whereas out of doors 75 per cent. of the males were *P. noguchii*, it was assumed that all females taken in houses were *P. verrucarum*.

Of the four lots of crushed sandflies that proved infective to monkeys, one contained all three species, one was believed to contain only *P. noguchii*, and two consisted of *P. noguchii* with possibly a few individuals of *P. verrucarum*.

Six monkeys exposed to the bites of sandflies in Peru, three in a house where *P. verrucarum* was abundant and three in an excavation where *P. noguchii* was fairly common, were taken to New York, where examinations of their blood proved negative.

Shannon (R. C.). **Entomological Investigations in Connection with Carrión's Disease.** *Amer. J. Hyg.*, x, no. 1, pp. 78–111, 2 pls., 6 figs., 43 refs. Baltimore, Md., July 1929.

These investigations in connection with the transmission of verruga [see preceding paper] were carried out in the Rimac valley, Peru.

The work of Townsend [*R.A.E.*, B, iv, 65 ; xv, 159 ; etc.], Noguchi [xvi, 17] and others on the problem is briefly reviewed.

Phlebotomus verrucarum, Towns., *P. noguchii*, Shannon, and *P. peruensis*, Shannon, are described in detail, and comparative tables of the measurements of various parts in both sexes of each of the three species and a key to the males are given.

Verruga is confined to the narrow mountain valleys on the western slopes of the Peruvian Andes, between 6 and 13° S. lat., at elevations between 2,500 and 8,000 feet. A list is given of localities in which verruga is known to occur ; sandflies (*Phlebotomus*) have been found in three of these, but no search for them has been made in the others. The disease is contracted at night, both indoors and far from habitations, and at any time of year. These facts provide reasons for excluding from consideration as possible vectors all the blood-sucking Arthropods, with the exception of *Phlebotomus*, found in the Rimac valley, a list of which is appended. Specimens of some 25 of the commoner species were tested bacteriologically, with negative results [see preceding paper]. Nearly all the commoner species also occur outside the verruga zone, whereas those that are more closely confined to the region rarely, if ever, attack man ; moreover, all are closely restricted to limited breeding-places. *Phlebotomus verrucarum* and *P. noguchii* taken together conform to all the requirements. No sandflies were found in verruga-free parts of the Rimac valley adjoining the verruga zone, and the disease is not contracted from infected persons outside the areas in which sandflies occur.

The climate of the Rimac valley and the characteristics of the verruga zone are described. The moderate rainfall and benign night temperatures of the verruga zone are favourable to the existence of *Phlebotomus* ; in the wet (winter) season, the night temperatures range from 53 to 60° F., and the maximum day temperatures from 68 to 85° F. In the dry season, the minimum and maximum are about 60 and 90° F., respectively. Higher up the valley, the lower night temperatures inhibit the night activity of sandflies, 55° F. being apparently the lowest temperature at which they are normally active. Lower down the valley, the conditions are too arid for sandflies to breed.

The sandflies remain inactive throughout the day, even in dark caves and excavations ; they are active from the approach of darkness (about 6.30 p.m.) until about 10 p.m., or sometimes later. They were observed to bite man, horses, donkeys, dogs, monkeys, fowls and doves, but not lizards. In spite of careful search in apparently favourable situations, rabbit warrens, under fowl roosts, at bases of walls, etc., no larvae of *Phlebotomus* were found. The sandflies are probably most numerous from March to the middle of June, and this is the season when verruga is most prevalent.

The author and his assistant slept in the verruga zone for 2–5 nights a week for four months, protected from the bites of sandflies, without contracting the disease. It is recommended that visitors to the region should apply citronella oil or some other repellent to the exposed parts of the body, both indoors and out of doors, that they should sleep under a mosquito net, and that they should not sleep in darkened rooms by day without the protection of mosquito netting or citronella oil. Tents should be pitched at least a quarter of a mile from rocky mountain slopes, stone walls, native houses, etc. A well-built house, with concrete floors and walls without cracks, in a flat area away from

rocks, will probably afford sufficient protection without additional precautions, but the outside walls may be treated with creosote. A good coating of creosote should be maintained in and around labourers' quarters, especially on the under side of the floor covering.

The author's observations did not indicate any one species of animal as a probable natural reservoir of verruga, their numbers in all cases being too small ; only four geckos were found as the result of considerable search. Many animals, both wild and domestic, have been reported to be susceptible to the disease.

Botsford (R. C.). **Mosquito Control Work in Connecticut in 1928.**—*Bull. Connecticut Agric. Expt. Sta.*, no. 305, pp. 753–761, 4 pls. New Haven, Conn., April 1929.

As in the two previous years, mosquitos were very abundant in Connecticut during 1928. A detailed account is given of the mosquito control work carried out during the season, which consisted largely of supervising the treatment of breeding areas and was concerned especially with the ditching of salt marshes.

Britton (W. E.). **Carrion Flies killed by Fungus.**—*Bull. Connecticut Agric. Expt. Sta.*, no. 305, p. 763, 1 pl. New Haven, Conn., April 1929.

During the summer of 1928 large numbers of dead flies were found adhering to the leaves and stems of garden plants. The flies, most of which were identified as *Lucilia sericata*, Mg., with an occasional individual of *L. sylvarum*, Mg., and *L. caesar*, L., had been killed by the fungus, *Empusa muscae*.

Rudolfs (W.) & Lackey (J. B.). **Effect of Food upon Phototropism of Mosquito Larvae.**—*Amer. J. Hyg.*, x, no. 1, pp. 245–252, 7 refs. Baltimore, Md., July 1929.

Larvae of *Culex pipiens*, L., were observed to become negatively phototropic after being fed for several days on a culture of the Ciliate, *Paramecium*. Experiments were therefore carried out to determine the effect of various types of food on the reaction of mosquito larvae to light. The larvae of *C. pipiens*, *Aëdes vexans*, Mg. (*sylvestris*, Theo.) and *A. canadensis*, Theo., which were the species used, normally have a mixed diet, and are positively phototropic, although this characteristic is less marked in later stages. It was found that when they were on a restricted diet, the food organism apparently had a considerable effect in determining the phototropic reaction of the larvae, a pure diet of Ciliates producing a change from positive to negative within two days, whereas a diet of Dinoflagellates, *Chlamydomonas* or *Euglena*, intensified the positive reaction, which remained strong until shortly before pupation. When one of these three types of organisms was substituted for Ciliates, there was an immediate tendency to change, but the reverse had little effect.

When the larvae were fed on a mixture of organisms, they all produced adults, and in some cases the same occurred when they were fed on pure cultures of organisms (*e.g.*, *Euglena*, *Chlamydomonas*). In other cases, however, 20–40 per cent. of the larvae fed on pure cultures failed to produce adults. This agrees with field observations, in

which certain pools containing almost pure cultures of a specific organism, in apparently sufficient quantity, contained few or no larvae. It seems that, under certain conditions, mosquitos reared upon more or less pure food cultures produced infertile eggs.

It is suggested that changes in the food-supply produce chemical changes in the bodies of the larvae that affect their phototropic reactions, and that the change of these is one of a series of changes resulting in differences in behaviour, stunted or slow growth and possibly infertility, for which the chemical composition of the food is responsible. If this is so, it is thought that the changes must be caused by small quantities of some specific substance.

MOORE (H. W. B.). **Egg-laying Capacities of Malaria Mosquitoes.**—*Agric. J. Br. Guiana*, ii, no. 2, pp. 69–75. Georgetown, June 1929.

In British Guiana, where malaria is the most serious disease, experiments were carried out to determine the egg-laying capacity of the two Anophelines present on the coast, namely, *Anopheles tarsimaculatus*, Goeldi, and *A. argyritarsis*, R.-D. It was found to be very high and very similar in both species, averaging approximately 1,000 eggs for each female. The mosquitos are capable of engorging at least 7 times and of ovipositing after each meal. Only one pairing is necessary for the production of fertile eggs, and this probably occurs immediately upon emergence of the insects from their breeding-places. The time between the blood meal and oviposition is very short (from 2 to 5 days) and also that between oviposition and hatching (from 2 to 3 days). The females are ready for a blood meal soon after oviposition. Captive mosquitos fed promptly and regularly upon blood may live for more than three weeks.

FLU (P. C.). **Verslag van een studiereis naar Suriname (Nederlandsch Guyana), Sept. 1927-Dec. 1927, en beschouwingen dienaangaande.** [Report on an Expedition to Surinam, September–December 1927, and Observations on it.]—*Acta Leidensia Scholae Med. trop.*, iii, pp. 1–192, 61 figs. Leyden, 1928. (With a Summary in English.)

An account is given of studies on various health problems in Dutch Guiana. At Paramaribo, the water-supply is obtained from rainwater collected in wells and other reservoirs that may become breeding-places of *Culex fatigans*, Wied., and *Aëdes* (*Stegomyia*) [*argenteus*, Poir.]. Both these mosquitos are vectors of *Filaria bancrofti*, the rate of infection being 27 per cent. in *C. fatigans* and 8·3 per cent. in *A. argenteus*. In some parts of the town, 38 per cent. of the examples of *C. fatigans* taken in dwellings were infected. Experimentally *A. argenteus* was as readily infected as *C. fatigans*, and the lower percentage of infection in nature is believed to be due to the fact that during the first few days of its life this mosquito only bites by day and so cannot acquire infection, though after the third day of life it only bites at night. A mosquito only becomes infective 14 days after the infecting feed, so that *C. fatigans*, which is able to become infected on emergence, is more likely to live long enough to become a transmitter.

As regards malaria, *Anopheles tarsimaculatus*, Goeldi, finds excellent breeding-places in the rice-fields, some of which border on the houses

in some parts of Paramaribo. An investigation failed to detect enlarged spleens in children living at a distance of about 550 yards from rice-fields, and while this requires confirmation on a large scale at a season more favourable to malaria, it may be shown that *A. tarsimaculatus* does not spread malaria at a distance.

Yellow Fever at Rio de Janeiro.—*Publ. Hlth. Rep.*, xliv, no. 28, pp. 1657–1659, 1 ref. Washington, D.C., 12th July 1929.

A further account is given of the epidemic of yellow fever in Rio de Janeiro, Brazil, and the measures taken for its control [*R.A.E.*, B, xvii, 69]. From October 1928 to January 1929 few cases were observed, but from January onwards the prevalence of the disease increased. The constant high temperature and frequent rains reduce the period of development of the mosquito vector [*Aëdes argenteus*, Poir.] during the summer months from 12 to 7 or 8 days, and the work of control is rendered more difficult because, if a breeding-place is overlooked during one of the weekly visits, the adults emerge before the next. In addition, the mosquitos driven out of houses lay their eggs in the eaves, in hollows in trees, on the ground and in any more or less remote place where there is a small quantity of water.

Martini (E.). **Tiergeographische Gesichtspunkte zur Beurteilung der Geschichte und Epidemiologie des gelben Fiebers.** [A Consideration of the History and Epidemiology of Yellow Fever from the Zoogeographical Viewpoint.]—*Verh. deuts. Ges. angew. Ent., 7. Mitgliederversamml. München, 31. Mai–2. Juni 1928*, pp. 76–81. Berlin, 1929.

The different features characterising the occurrence of yellow fever in West Africa and in America and the problem of the country of origin of the disease are discussed. *Aëdes argenteus*, Poir. (*fasciatus*, F.), the vector in both continents, is the only representative of the subgenus *Stegomyia* found in America, whereas many closely allied species occur in Africa. Apart from *A. argenteus* and *Culex pipiens*, L., which is also associated with man, the only mosquitos common to both hemispheres are species confined to the north. It is therefore concluded that the disease originated in Africa and was only introduced into America after the discovery of that continent, to which *A. argenteus* was carried by ship in association with man. The milder type of fever common in Africa is accounted for by the wide distribution of the infection over thinly populated areas where a degree of immunity has been acquired, and to the absence of large cities with fluctuating populations such as are generally the sites of severe outbreaks in America. Serious epidemics are therefore not to be expected in Africa apart from the progress of civilisation, white immigration or fluctuation in the population, though anti-mosquito measures should be adopted wherever towns are developed.

Edwards (F. W.). **Philippine Nematocerous Diptera. II.** *Notul. ent.*, ix, no. 1, pp. 1–14. Helsingfors, 10th May 1929.

This paper contains a revised list, with synonyms, of the 101 known Philippine mosquitos, with notes on some types and other specimens examined in Washington.

Other Diptera mentioned include two species of *Simulium*, one new and the other unidentified, no Simuliid having previously been recorded from the Philippines.

MANALANG (C.). **The Buccopharyngeal Armature of Philippine Anophelines.**—*Philipp. J. Sci.*, xxxviii, no. 4, pp. 431–435, 4 pls. Manila, April 1929.

A study was made of the buccopharyngeal armature of the commoner species of Philippine Anophelines, namely, *Anopheles minimus*, Theo., *A. ludlowi*, Theo., *A. subpictus*, Grassi, *A. vagus*, Dön., *A. kochi*, Dön., *A. tessellatus*, Theo., *A. philippinensis*, Ludl., *A. fuliginosus*, Giles, *A. hyrcanus*, Pall., *A. barbirostris*, Wulp, *A. maculatus*, Theo., *A. karwari*, James, and an unnamed species, probably new, the larva and adult female of which are described.

The results confirm the observations of Barraud and Covell [*R.A.E.*, B, xvi, 176] except in the case of *A. ludlowi*. In the Philippines there appear to be two varieties of this species, in one of which the number of teeth in the buccopharyngeal armature is similar to that in *A. subpictus*; it is possible, therefore, that this form should be regarded as a variety of the latter.

HOFLIN (J. W.). **Annual Report of the Malaria Advisory Board for the Year 1928.**—Fol., 12 pp. Kuala Lumpur, 1929.

Investigations into the question of malaria in rice-fields in the Federated Malay States have led to the conclusion that in the hilly districts malaria in the rice-fields is so largely due to the presence of *Anopheles maculatus*, Theo., that the problem is inseparable from the general one of malaria in the hilly districts, and that therefore little would be gained by making it a matter for separate study or by expenditure in that direction. A study of the larvicidal value of oils distilled from scrap rubber showed that although these oils are rapidly fatal to Anopheline larvae and spread quickly into a uniform film, evaporation is very rapid and the toxic action quickly disappears; they are also at present more expensive than other oils in use. The drug plasmoquin is said to have a specific effect on the mosquito-infecting forms of the malarial parasite, and its use in conjunction with quinine should be given an extended trial.

WALCH (E. W.) & BONNE-WEPSTER (J.). **Vergelijkend onderzoek van enkele oliesoorten en mengsels hiervan als larvendoodende middelen.** [A comparative Examination of some Oils and Mixtures of them as Larvicides.]—*Geneesk. Tijdschr. Ned.-Ind.*, lxix, no. 4, pp. 333–349. Weltevreden, 10th April 1929. (With a Summary in English.)

These experiments were made in order to find an Anopheline larvicide suited to the conditions in the Dutch East Indies and less expensive than the solar oil now generally used. The materials tested included many mentioned in the literature, and the results are given in detail. The substance recommended is "sludge," a waste product of the residue manufacture of the Batavian Petroleum

Company. Even in breeding-places with a great many algae, 5 cc. per square metre is sufficient if it is evenly distributed. In practice 7½–10 cc. should be used. If the destruction of aquatic vegetation is unimportant, the still cheaper waste crank-case oil may be employed, of which, however, 40 cc. per square metre is needed. By adding 10 per cent. kerosene and 1–2 per cent. coconut or castor oil, a mixture is obtained that gives good results at 20–10 cc. and does not do so much harm to the vegetation. A mixture of 3 parts waste oil and 1 part solar oil also gives good results at 20 cc.

Soesilo (R.). **Uittreksel uit het rapport omtrent het onderzoek naar de verspreiding van de malaria op het eiland Nias.** [Extract from the Report on the Investigation of the Distribution of Malaria in the Island of Nias.] —*Geneesk. Tijdschr. Ned.-Ind.*, lxix, no. 4, pp. 350–368, 2 maps. Weltevreden, 10th April 1929; also in English in *Meded. Dienst. Volksgez. Ned.-Ind.*, Foreign edn., xviii, no. 1, pp. 85–110, 1 map. Weltevreden, 1929.

Malaria is severe in certain parts of the island of Nias, particularly in a district comprising both hilly and low-lying marshy land on the east coast. In the marshlands, malignant tertian predominates, *Anopheles ludlowi*, Theo., is the mosquito most commonly found, and the spleen index is 96 per cent. In the hilly areas benign tertian predominates, *A. maculatus*, Theo., is the commonest mosquito, and the spleen index is 30·8 per cent.

Land converted into rice-fields, but still remaining marshy after the harvest, was found to harbour *A. ludlowi*, although the water was not brackish. It was not, however, found in marsh water more or less shaded by denser vegetation.

Other species in the lowlands are *A. barbirostris*, Wulp, *A. hyrcanus* var. *sinensis*, Wied., *A. umbrosus*, Theo., *A. aitkeni*, James, *A. kochi*, Dön., *A. tessellatus*, Theo., *A. leucosphyrus*, Dön., and *A. maculatus*. In the hilly areas *A. maculatus* occurred in 505 out of 699 breeding-places, the other species being *A. aitkeni*, *A. barbirostris*, *A. tessellatus*, *A. kochi*, *A. leucosphyrus*, and *A. umbrosus*.

Of 256 specimens of *A. ludlowi*, 7 were infected with malarial parasites, while of 137 specimens of *A. tessellatus*, 1 appeared to harbour cysts. *A. ludlowi* must be regarded as the chief vector in the marshlands; it is probable that *A. maculatus* is also concerned and is the vector in the hills.

Huisman (R. G. J. P.). **Malaria en Anophelinen in het bergland van Ceram.** [Malaria and Anophelines in the Hill Country of Ceram.] —*Geneesk. Tijdschr. Ned.-Ind.*, lxix, no. 4, pp. 369–376, 1 pl., 1 map, 3 refs. Weltevreden, 10th April 1929.

An investigation made in 1928 showed indigenous malaria to be present in the hill country of Ceram. The Anophelines observed were *Anopheles punctulatus*, Dön., a recorded vector, the larvae of which always occurred in unshaded pools and never in swiftly running water; *A. barbumbrosus*, Strickl. & Chdy. (*barbirostris* var. *pallidus*, Swell.); and *A. aitkeni* var. *insulaeflorum*, Swell., which has been suspected of transmitting the disease.

OTTOLENGHI (D.) & others. **Le condizioni della malaria e la lotta antimalarica nelle bonifiche ferraresi. (Relazione per gli anni 1927-28.)** [Conditions relating to Malaria and anti-malarial Work in the anti-malarial Campaign in Ferrara. Report for 1927–28.]—*Riv. Malariologia*, viii, no. 2, pp. 113–148, 2 maps. Rome, 1929. (With Summaries in Italian, p. 233, French, p. 234, English and German p. 235.)

Observations on the results of a campaign against malaria [*R.A.E.*, B, xv, 182] were continued in the district of Ferrara in 1927–28. They showed with increasing clearness the relation between a complete campaign that had reached a fairly advanced stage and the recovery from malaria in the districts in question. In one of these districts, houses are scattered in large areas intersected by canals, and the hypothesis is advanced that each house becomes the centre of an Anopheline population belonging to the adjacent breeding-places, such groups not tending to mix with each other or to migrate to any distance, and being therefore less apt to spread malaria from one house to another. This would be of great importance in localities where reclamation work is being done, provided that the mosquitos find adequate food and shelter indoors. An attempt to test this was made by studying the ordinary periodic migration of Anophelines from houses and animal quarters, by releasing stained individuals, and by tracing stained individuals left free indoors. While further observations are needed, it would seem that the evening flight is governed by the instincts of oviposition and mating, and that some individuals can travel as much as 4½ miles. As, however, only 63 out of 5,600 stained mosquitos were recaptured and the conditions were somewhat artificial, the normal migration is better ascertained by staining mosquitos in their ordinary shelters. None of these latter were taken at a distance.

Anopheles maculipennis, Mg. (*claviger*, auct.) and *A. sacharovi*, Favr (*elutus*, Edw.) were found experimentally capable of acquiring infection both in one district where malaria was absent, as well as in another district where it was still widespread. The difference in the occurrence of the disease is due to the protection afforded by the presence of stabled animals. In both districts there was a marked preference for cattle over man. In one experiment the mosquitos from houses without stables were always more ready to attack man than those from a stable in the same zone. This difference in food preferences agrees with the characters of the maxillary index indicated by Roubaud [*R.A.E.*, B, x, 53]. The size of the mosquitos, judged by the size of the wings, is not uniform in the districts of Ferrara. Size does not, however, affect the capacity to transmit malaria, though the smaller individuals predominate in zones free from the disease. As the contrary has been noticed in other regions, size is not a racial character necessarily connected with the capacity for harbouring the malarial parasite.

A. algeriensis, Theo., must be added to the species already recorded from Ferrara [*loc. cit.*]. *A. maculipennis* showed a positive chromotropism for carmine, yellow and blue, and a negative chromotropism for white, grey and some shades of green. This may prove of value in encouraging entry into stables and discouraging it in houses.

Experiments in dusting with Paris green against the larvae were made in 1928 and are described at length. There resulted a sufficient

decrease in the number of mosquitos to justify the adoption of this practice, especially where it is desired to keep malaria in check while a radical campaign is being carried out.

Vidale (E.) & Sepulcri (P.). **Tropismi nell'ovoposizione degli anofelini.** [Tropisms in the Oviposition of Anophelines.]—*Riv. Malariologia*, viii, no. 2, pp. 172–175. Rome, 1929. (With Summaries in Italian, p. 233, French, p. 234, English, p. 235, German, p. 236.)

The Anophelines found in Venetia are *Anopheles maculipennis*, Mg., *A. sacharovi*, Favr (*elutus*, Edw.) and *A. algeriensis*, Theo., the last-named being scarce and restricted to certain localities. This paper draws attention to tropisms of the two other species to various liquids and to different concentrations of salt (sodium chloride). The experiments were made from June to September. In decreasing order of preference, the liquids chosen for oviposition were ditch water, canal water, pump water and 5–10 per mille solutions of salt, 0·05–0·2 per mille solutions of potassium permanganate (which permitted development only up to the first larval instar), and solutions of salt from 15 to 20 per mille. In ditch and canal water there was an absolute predominance of the black eggs of *A. maculipennis* with large floats. Whereas the few eggs of *A. maculipennis* laid in the more concentrated salt solutions soon turned yellow and died, those of *A. sacharovi* produced several larval instars in concentrations up to 15 or even 20 per mille. The results with salt solutions agree with the observed preference of *A. sacharovi* for saline waters, and explain the predominance of this Anopheline in the lagoon districts of Venetia.

[Mitrofanova (Yu.).] **Митрофанова (Ю.). Zur Culicidenfauna des Mittleren Urals.** [*In Russian.*]—*Bull. Inst. Rech. biol. Univ. Perm.*, vi, pt. 8, pp. 373–376. Perm, 1929. (With a Summary in German.)

This is a list of 24 species of mosquitos collected by the Malaria Section of the Perm Bacteriological Institute during 1924–28 on both sides of the Central Urals. The Anophelines found were *Anopheles maculipennis*, Mg., and *A. bifurcatus*, L.

[Dzhaparidze (P.).] **Джапаридзе (П.). Zur Frage der Verbreitung, Epidemiologie und zur Bekämpfung tropischer Krankheiten in Abchasien nach dem von Expeditionen gesammelten Material in Jahren 1927-28.** [*In Georgian.*]—*Nachr. trop. Med.*, ii, no. 4, pp. 263–279, 8 figs. Tiflis, April 1929. (With Summaries in Russian and German, pp. 321 & 324.)

In the course of investigations on the occurrence of tropical diseases, including malaria, in Abkhasia in the summers of 1927 and 1928, numerous Anophelines were found in various parts of the country, the species represented being *Anopheles maculipennis*, Mg., which was abundant, *A. bifurcatus*, L., and *A. plumbeus*, Steph. The application of Paris green and the introduction of *Gambusia* are recommended against the larvae, and drainage should be carried out on a large scale along the sea coast.

[Martzinovskiĭ (E. I.).] **Марциновский (Е.). Ueber die Bekämpfungsmassnahmen des Denguefiebers.** [*In Georgian.*]—*Nachr. trop. Med.*, ii, no. 4, pp. 280–284, 1 graph. Tiflis, April 1929. (With Summaries in Russian and German, pp. 322 & 325.)

The following has been taken from the summary: In connection with the last epidemic of dengue in Greece in 1928, the author points out that *Aëdes argenteus*, Poir. (*aegypti*, L.) occurs in several places along the Black Sea coast [*cf. R.A.E.*, B, xvii, 107] and recommends various precautions against the introduction of the disease into Georgia.

[Martzinovskiĭ (E. I.).] **Марциновский (Е. И.). Les mesures contre l'introduction de la dengue.** [*In Russian.*]—*Russ. J. Trop. Med.*, vii, no. 3, pp. 162–165, 1 map. Moscow, 1929.

This and the following papers are reports delivered at a conference held in Moscow on the 5th and 6th March 1929 in view of the danger of the introduction of dengue on the Black Sea coast of Georgia. The distribution in this area of *Aëdes argenteus*, Poir. (*aegypti*, L.) is briefly reviewed [*R.A.E.*, B, xvii, 107]; it is often imported into the country in ships from Trebizond. The transmission of dengue by *Culex fatigans*, Wied., has so far not been proved, and but little is known of its occurrence in the Caucasus. A programme is outlined of the organisation of a campaign against the disease if it should be introduced into the country and of quarantine measures to prevent its introduction, and a careful study of the bionomics of *A. argenteus* and *C. fatigans* under local conditions is recommended.

[Rukhadze (N. P.).] **Рухадзе (Н. П). Sur la possibilité de l'introduction de la dengue à Batoum.** [*In Russian.*]—*Russ. J. Trop. Med.*, vii, no. 3, pp. 166–168. Moscow, 1929.

Though the part played by *Culex fatigans*, Wied., in the transmission of dengue is doubtful, this mosquito should not be ignored in the organisation of a campaign against *Aëdes argenteus*, Poir. (*Stegomyia fasciata*, F.). As a certain temperature is essential for the development of the disease, it is not difficult to determine the geographical boundaries of its spread and, consequently, of the quarantine lines that should be drawn to the north and south of infested regions. The distribution of *A. argenteus* in Georgia is briefly reviewed, and special attention is drawn to Batum, as the chief focus of infestation; the danger of the introduction of the disease by ships from Greece and Turkey is pointed out.

[Shingarev (N. I.).] **Шингарев (Н. И.). Sur les moustiques vecteurs de la dengue.** [*In Russian.*]—*Russ. J. Trop. Med.*, vii, no. 3, pp. 168–170, 1 pl. Moscow, 1929.

The history of dengue is briefly outlined, and the possibility of its transmission by species of mosquitos other than *Aëdes argenteus*, Poir., and *Culex fatigans*, Wied., is pointed out. The author suggests

that *C. pipiens*, L., which is found in all the regions where outbreaks of the disease occur, and mosquitos of the genera *Theobaldia* and *Taeniorhynchus* may also be vectors, and experiments with them should therefore be made. The importance of a detailed and immediate study of the bionomics of *C. fatigans* in Georgia is emphasised, and the male genitalia and larval characters of this species and of *C. pipiens* are briefly discussed.

[Dmitriev (I. D.).] **Дмитриев (И. Д.). Matériaux touchant à la répartition des moustiques en le littoral caucasien de la Mer Noire.** [*In Russian.*]—*Russ. J. Trop. Med.*, vii, no. 3, pp. 176–182. Moscow, 1929.

The mosquitos found in 1927 along the east coast of the Black Sea comprised ten species, including *Anopheles maculipennis*, Mg., *A. hyrcanus* var. *pseudopictus*, Grassi, *Aëdes argenteus*, Poir. (*aegypti*, L.), and *Culex pipiens*, L. Those collected by the author in the summer of 1924 in a military hospital in the centre of Batum were chiefly *C. pipiens*. Of the mosquitos found in barracks in various towns in 1926 and 1927, about 40 per cent. were *Anopheles maculipennis*; *Aëdes argenteus* only occurred in insignificant numbers.

[Lindtrop (G. T.).] **Линдтроп (Г. Т.). Quelques renseignements historiques sur l'état actuel de la question concernant la zoogéographie du vecteur de la fièvre jaune et de la dengue au Caucase.** [*In Russian.*—*Russ. J. Trop. Med.*, vii, no. 3, pp. 183–191, 14 refs. Moscow, 1929.

Previous studies on the distribution of *Aëdes argenteus*, Poir. (*aegypti*, L.) in Russia are discussed in detail; in Transcaucasia the endemic foci of this mosquito occur as far north as 43° N. lat., including Sukhum, and it is sometimes transported in ships to other ports further north (*cf. R.A.E.*, B, xiv, 150). A list is given of towns in Georgia in which *A. argenteus* occurs and of those that are free from it. The absence of this mosquito from Azerbaijan and the steppe districts in Transcaucasia is explained by the lack of humidity in these regions. Many years' observations have shown that artificial water reservoirs are the only natural breeding-places of *A. argenteus*; it is important, therefore, that these should be destroyed and the towns, especially the ports, provided with a pipe-borne water-supply.

Moutoussis (K.). **Befunde von rickettsiaartigen Gebilden und Einschlüssen in mit Denguefiebervirus infizierten Stegomyien.** [The Occurrence of *Rickettsia*-like Forms in *Aëdes argenteus* infected with Dengue Virus.]—*Arch. Schiffs- u. Tropenhyg.*, xxxiii, no. 6, pp. 330–333, 1 pl. Leipzig, June 1929.

During the epidemic of dengue in Greece, about 80 per cent. of the population was infected in August and September 1928. Of some 1,000,000 cases, 650,000 occurred in Athens and Piraeus, and about 1,500 proved fatal.

The intestinal contents of individuals of *Aëdes argenteus*, Poir. (*Stegomyia fasciata*, F.) fed on persons infected with dengue were found to contain bodies similar to *Rickettsia prowazeki*, which were not, however, observed in the salivary glands.

KADLETZ (N. A.) & [KUZMINA] KUSMINA (L. A.). **Experimentelle Studien über den Saugprozess bei** *Anopheles* **mittels einer zwangsweisen Methode.** [Experimental Studies on Sucking in *Anopheles* by Means of a compulsory Method.]—*Arch. Schiffs- u. Tropenhyg.*, xxxiii, no. 6, pp. 335–350, 2 figs., 28 refs. Leipzig, June 1929.

It has been possible to investigate a number of questions connected with the sucking process in *Anopheles maculipennis*, Mg., and *A. bifurcatus*, L., by means of a method somewhat similar to one already noticed [*R.A.E.*, B, xv, 160] that causes a mosquito to suck more readily at the will of the operator. The mosquito is held between a piece of glass and a piece of thin paper, and its proboscis is inserted into a capillary tube containing the fluid. Both summer and winter generations were used. In decreasing order of preference the following fluids were accepted : sugary syrup, sweetened meat-peptone bouillon, human blood (defibrinated or citrated), and tap-water. Mosquitos that had refused to feed voluntarily when placed on the fore-arm fed from the capillary tube. Captured mosquitos fed with progressive frequency at the approach of spring, those taken in winter in warm cellars feeding more frequently than those from cold cellars until May. The mechanism of ingestion was studied, and some information was obtained on the physiological importance of the crop. This organ serves to store food and receives all plant-juices and some of the blood. The dependence of ovarian development on a feed of blood was studied, and the results support Kozhevnikov's view that a period of rest is required before a third oviposition. A rest period (cyclical asthenobiosis) appears to be essential in the life of the mosquito, and the activity of the ovary is checked during it.

[RUKHADZE (N. P.).] **Рухадзе (Н. П.). Zur Biologie des** *Anopheles nigripes*. [*In Georgian.*]—*Nachr. trop. Med.*, ii, no. 5, pp. 336–344, 5 figs. Tiflis, May 1929. (With Summaries in Russian and German, pp. 404–405 & 410–411.)

In the course of further observations on the breeding-places of *Anopheles plumbeus*, Steph. (*nigripes*, Staeg.) [*R.A.E.*, B, xiv, 161] in the town of Sukhum and its vicinity, the larvae were found in a river above a dam, and, together with those of *Aëdes* (*Finlaya*) *geniculatus*, Ol., and *A.* (*Ochlerotatus*) *pulchritarsis*, Rond., in a forest in hollows of trees containing stagnant water. In the town itself, they were sometimes accompanied by the larvae of *Theobaldia annulata*, Schr., *A. argenteus*, Poir. (*aegypti*, L.), *Culex pipiens*, L., and other Culicines, in a variety of domestic containers and accidental collections of water, all these reservoirs containing stagnant water, usually polluted by decomposing organic matter. In the autumn they harboured many more larvae of *A. plumbeus* than in the summer, owing to the fact that in the summer the average temperature of water in artificial containers is 20° C. [68° F.], this being too high for the breeding of the larvae, whereas in the autumn the temperature does not exceed 8–12° C. [46·4–53·6 ° F.] and offers favourable conditions for their development.

[Korostelev (V. E.).] **Коростелев (В. Е.). Encore sur l'effet larvicide du vert de Paris.** [*In Russian.*]—*Russ. J. Trop. Med.*, vii, no. 4, pp. 299–303, 5 refs. Moscow, 1929. (With a Summary in French.)

In continuation of previous work [*R.A.E.*, B, xvii, 6], further laboratory and field experiments were made by the author in the summer of 1928 in the Ukraine with Paris green as a larvicide against *Anopheles maculipennis*, Mg. The poison tested was mixed with road dust in the proportion of 1 : 40, and applied, unless otherwise stated, at the rate of 0·1 gm. of the poison to 1 sq. m. of water surface. At a higher rate, its lethal effect was accelerated; when used under laboratory conditions against fourth instar larvae at the rate of 0·01 gm., it killed the larvae in 4 hours, while at 1 gm. it destroyed them in 2½ hours. A higher temperature of the water also increased the effect of the poison; when it was applied at a temperature of 15° C. [59° F.], the larvae died in 1 hour 50 mins., whereas at a temperature of 30° C. [86° F.] they were killed in 35 mins. The larvae were in the second instar, which accounts for the accelerated effect of the poison on them as compared to the probably more mature individuals used in experiments by Blagoveshchenskii [xvi, 200]. Field observations confirmed the laboratory tests, as in the summer the larvae were killed much more quickly than in the autumn. Laboratory experiments proved that Paris green applied in dosages sufficient to kill the larvae of *A. maculipennis* is not poisonous either to animals or fish. Dull weather and rain did not decrease its effectiveness. The treated waters became reinfested in 3–4 weeks.

[Belitzer (A. V.).] **Белицер (А. В.). Les stades infectants des tiques vecteurs de la piroplasmose équine dans les gouvernements du centre de l'U.d.R.S.R.** [*In Russian.*]—*Russ. J. Trop. Med.*, vii, no. 4, pp. 258–262, 4 refs. Moscow, 1929.

[Belitzer (A. V.).] Bielitzer (A. W.). **Kann die Nymphe der Milbe *Dermacentor reticulatus* die Pferde mit *Piroplasma* anstecken?** [Can the Nymph of *D. reticulatus* infect Horses with Piroplasmosis?]—*Zbl. Bakt.*, (1) Orig., cxii, no. 6–8, pp. 439–440, 4 refs. Jena, 28th June 1929.

In connection with successful experiments made by du Toit in the transmission of *Piroplasma* (*Babesia*) *caballi* to horses by the nymphs of *Dermacentor reticulatus*, F. [*R.A.E.*, B, viii, 151], and in continuation of previous work by the author [xiii, 53; xvi, 77], further laboratory and field experiments were carried out in the summer of 1925 in the Ryazan Government and are discussed in detail. Nymphs derived from females of *D. reticulatus* that had fed on a horse infected with piroplasmosis were placed on a healthy horse, but no infection resulted and the nymphs did not remain on the host. Furthermore, no nymphs were found on a horse kept in a pasture infested by *D. reticulatus*, although they occurred on small rodents in the same field; the horse remained healthy throughout the summer, but became infected with piroplasmosis in autumn probably caused by several adult ticks that were found on it.

In laboratory experiments in 1928, infected nymphs fed on a horse in summer did not transmit the disease to it, but in the autumn when

they had become adult they infected the same animal in 10 days with a typical form of piroplasmosis.

The author concludes that in the central governments of Russia the nymphs of *D. reticulatus* do not usually infest horses or other large animals in nature, and that infection with *Piroplasma caballi* is transmitted from a tick to its offspring and is preserved in them whatever may be the animals on which the larvae and nymphs feed, but can only be transmitted to a horse by an adult tick.

FERMI (C.). **Ueber die antimalarische Zooprophylaxis. Kurze Mitteilung.** [Antimalarial Zooprophylaxis. A short Communication.] —*Zbl. Bakt.* (1) Orig., cxii, no 6–8, pp. 480–481. Jena, 28th June, 1929.

The number of Anophelines in inhabited places is directly related to the number of animals quartered by night in buildings within such centres. The less well constructed the buildings, the greater the number of Anophelines in dwellings. If animal quarters are to be effective in protection, they must be well built and at a distance (50–100 yards) from the dwelling.

EWING (H. E.). **A Manual of External Parasites.**—8vo, xiv+225 pp., 96 figs. Springfield, Ill., C. C. Thomas; London, Baillière, Tindall & Cox, 1929. Price 20*s.* net.

This manual deals exclusively with the five major groups of ectoparasites; the mites, ticks, Anoplura, Mallophaga and fleas. Keys are given in most instances to the known genera of the world, and the amount of space allotted to the different groups has been determined largely by the number of genera and higher groups included. The economic aspect of the ectoparasites is not dealt with at any length; attention is given rather to their more evident morphological characters and to an enumeration and synopsis of their taxonomic groups, with short discussions of their life-histories and natural relationships; thus, the economically important group of ticks is allowed far less space than the less economically important biting lice.

In an appendix, descriptions are given of new genera proposed in the text belonging to each group except the ticks. Among these are *Echinolaelaps*, type *Laelaps echidninus*, Berl.; *Columbicola*, type *Esthiopterum columbae*, L.; and *Bovicola*, which is erected for the species of *Trichodectes* that attack bovines and includes *caprae*, Gurlt (the type), of which *limbatus*, Gerv., is possibly a synonym, *ovis*, L., and *bovis*, L.

LASNET (—). **Aperçu sur la fréquence de la peste dans les colonies françaises au cours des dix dernières années.**—*Ann. Méd. Pharm. col.*, xxvii, no. 1, pp. 5–94. Paris, 1929.

This review of the occurrence of plague in Indo-China, Madagascar, Réunion and French West Africa during the past ten years includes individual reports by several authors dealing with territories in Senegal and Madagascar, where the flea concerned in the transmission of the disease is almost exclusively *Xenopsylla cheopis*, Roths. In Senegal the degree of infestation of rats by this flea is greatest along the coast, where the lower temperature and greater humidity favour its longevity. *Mus rattus* was found to carry the greatest number of fleas, *M. rattus alexandrinus* and *M. rufinus* being only lightly infested. Other small

mammals examined, all of which were slightly infested, included *Golunda campanae*, *Crocidura stampfli* and *Cricetomys gambianus*. In the Cayor district of Senegal, where plague begins in February or March, in the middle of the dry season, and disappears or decreases considerably in the middle of the rainy season, the 1928 epidemic was preceded by a severe epizootic attacking rats and hares, but lasting only a short time. Rodents examined in August were all found to be infested with *X. cheopis*, but only to a slight degree. Apart from the coastal plague area, plague foci show a distinct tendency to die out. Biological conditions governing rats and fleas probably account for the existence of the plague area and the difficulty of transmission outside it. Beyond the railway, which forms the eastern boundary of the area, the temperature rises steadily, whereas humidity decreases. Rodents that find abundance of food and water in the coastal region throughout the year are therefore likely, if they leave the infected area, to move towards the south rather than in a northerly or easterly direction. This accounts for sudden invasions of rats that occur in the neighbourhood of Rufisque. Plague epidemiology in this region may further be accounted for by the application of Bacot's observations on the biology of *X. cheopis* [*R.A.E.*, B, ii, 62], according to which the eggs do not hatch at 55° F. and only 27 per cent. hatch at 93° F. It has further been observed in India that the infectivity of *X. cheopis* varied with the temperature, plague bacilli disappearing from the excreta when the flea is subjected to a temperature of 30–31° C. [86–88° F.]. The extension of the epidemic would therefore appear to be dependent on the human factor, but in spite of the fact that Moorish caravans continually cross the plague area, the disease remains localised. The yearly recrudescence of plague in the same region has not yet been adequately explained. Hitherto rodents were thought to constitute the reservoir of the virus, but recent studies have shown that certain fleas are able to preserve the bacillus for long periods even when unfed [xvii, 70].

In Madagascar, where the minimum number of cases occur in the dry and cold season in June and July and the maximum number in December, January and February, all the rats captured were *M. rattus alexandrinus* and were infested almost exclusively with *X. cheopis*. The recrudescence of plague at Antananarivo is associated with the artificial flooding of the rice-fields in the middle of August, when the rats take refuge in the town in large numbers. Plague diminishes again when the rice-fields are once more dry and the rats are able to return to them. An epizootic among rats at Tamatave in 1928 was followed by a rather severe epidemic of bubonic plague.

[Ignat'ev (A. K.) & Molodtzova (P. F.).] **Игнатьев (А. К.) и Молодцова (П. Ф.). Les puces des nids du spermophile** (*Citellus pygmaeus*) **dans la région de Tcherny Jar de l'arrondissement d'Astrakhan.** [*In Russian.*] — *Rev. Microbiol. Epidemiol. Parasitol.*, viii, no. 2, pp. 158–159. Saratov, 1929. (With a Summary in French, p. 225.)

In a study of the fleas infesting the nests of *Citellus pygmaeus* in Astrakhan carried out during 1926–29, 566 nests, containing 13,541 fleas, were inspected. The maximum number of fleas in a nest (225) was found in March, and the minimum (15) in August. The species

concerned, in order of the frequency of their occurrence, were *Neopsylla setosa*, Wagn., prevalent in winter, spring and summer; *Ctenophthalmus pollex*, Wagn., prevalent in autumn; *Ceratophyllus tesquorum*, Wagn., occurring throughout the year in small numbers; and *Frontopsylla semura*, Wagn., found only in summer. A table is given showing the change of the flea fauna in the nests according to the species and sex of the fleas and the months of the year.

[Raevskiĭ (A. S.).] **Раевский (А. С.). Pappataci Fever in Turkmenistan.** [*In Russian.*]—*Rev. Microbiol. Epidemiol. Parasitol.*, viii, no. 2, pp. 176–180, 2 refs., 4 figs. Saratov, 1929. (With a Summary in English, p. 227.)

This is an account of the outbreak of sandfly fever in the summer of 1928 near Askabad in Turkmenistan, where *Phlebotomus* is abundant. Of the species previously recorded [*R.A.E.*, B, xiv, 79] only *P. papatasii*, Scop., and *P. minutus*, Rond., were collected by the author.

Galli-Valerio (B.). **Notes de parasitologie.**—*Zbl. Bakt.*, (1) Orig., cxii, no. 1–2, pp. 54–59, 3 figs., 6 refs. Jena, 10th May 1929.

A case of creeping myiasis due to the larva of *Oestrus* (*Gastrophilus*) *intestinalis*, DeG. (*equi*, Cl.) is recorded in England, the patient working in a stable where one of the horses carried many eggs of this fly.

Of eleven individuals of *Argas columbae*, Herm. (*reflexus*, F.) placed in a container without food on 26th October 1925, four were still alive on 31st August 1927. Two still survived on 23rd November, and one on 3rd December 1928.

Vandenberg (S. R.). **Report of the Entomologist.**—*Rep. Guam Agric. Expt. Sta. 1927*, pp. 12–17. Washington, D.C., 1929.

A tick, probably *Rhipicephalus sanguineus*, Latr. (brown dog tick), is recorded as attacking dogs in Guam.

Carpano (M.). **Piroplasmosis in Egyptian Fowls** (*Egyptianella pullorum*).—*Bull. Minist. Agric. Egypt*, no. 86, 7 pp., 3 pls. Cairo, 1929.

A new Piroplasmid, *Egyptianella pullorum*, gen. et sp. n., is described from fowls in Egypt, and as some of the fowls were suffering from a double infection of *E. pullorum* and *Spirochaeta gallinarum*, it is suggested that the piroplasm may also be transmitted by *Argas persicus*, Oken. The disease does not appear to be severe in native fowls, but imported ones are sometimes killed by it.

Sturgess (G. W.). **Piroplasmosis.**—*Ceylon Adm. Rep. Vet. 1928*, p. H4. Colombo, 1929.

A small piroplasm, believed to be *Theileria mutans*, was found, from examination of blood films of apparently healthy cattle, to be practically

universal among those living in low-lying country. Though no symptoms are apparently produced by this piroplasm in native cattle born in endemic areas, it is probably responsible for the slow growth of calves of imported European blood.

Infection with *Piroplasma bigeminum* is also very common among low-country cattle, though cases showing severe symptoms are rare except when the cattle are weakened by food shortage, etc. The lack of immunity from *P. bigeminum* among cattle brought to the lowlands from up-country may be due to the possible absence at high altitudes of the transmitting tick, probably *Boophilus annulatus australis*, Fuller, or to the system of cattle rearing practised in up-country estates, whereby the cattle are housed from the time of birth and thus protected from infection and prevented from acquiring immunity.

Martin (A.) & Baradat (L.). **Existence de la piroplasmose et de la babésiellose bovines dans la Chalosse.**—*C.R. Soc. Biol.*, ci, no. 23, pp. 779–780. Paris, 1929.

In south-western France cattle have been found to be suffering from piroplasmosis caused in some cases by *Piroplasma bigeminum* and in others by *Babesiella bovis*. *Ixodes ricinus* L., and *Dermacentor reticulatus*, F., were found on the infected animals. This is the first record of the occurrence of *P. bigeminum* in France, previous records from Europe being from localities south of 44° N. lat.

Cousin (G.). **Remarques sur la vie larvaire de *Lucilia sericata* Meig.** —*C.R. Soc. Biol.*, ci, no. 22, pp. 653–654, 4 refs. Paris, 1929.

In continuation of previous work [*R.A.E.*, B, xvii, 100], the author undertook a study of the biology of the larvae of *Lucilia sericata*, Mg., and observed that a certain percentage of them underwent a diapause of longer or shorter duration while the others developed normally. In view of the theories of Roubaud [*R.A.E.*, B, xi, 55], he took an original stock that had already undergone the diapause, expecting to recover, after a number of generations with a normal life-cycle, a fresh series of larvae showing diapause phenomena. He first reared some hundred larvae taken after a month of diapause at ordinary temperature. The metamorphosis of these larvae was continued after a week at a temperature of about 32° F., and the adults reared from them oviposited normally. Each batch of larvae was observed separately but, contrary to expectation, the larvae showed great diversity of development. In each batch originating from the same female there was always a certain number of larvae that entered a diapause, and though some of these might be small in size as a result of insufficient food, others were of normal size. The author then attempted to establish stable conditions that would favour a constant normal cycle from egg to adult. This was successfully done, and permanent strains of *L. sericata* were produced without arrested development in the larval stage. The essential conditions were connected with temperature and humidity on the one hand and with the food and respiration of the larvae on the other. The author considers after several years' continuous experiments, that this form of latent life in *L. sericata* is an individual physiological state determined by exterior conditions, and not the result of hereditary intoxication.

Cousin (G.). **Conditions externes nécessaires pour obtenir un développement normal des larves de** *Lucilia sericata* **Meig.**—*C.R. Soc. Biol.*, ci, no. 23, pp. 788–790, 3 refs. Paris, 1929.

Details are given of the conditions of food, respiration, humidity and temperature necessary for maintaining the life-cycle of *Lucilia sericata*, Mg., without a diapause [see preceding paper]. If these conditions are carefully observed, there is not the slightest sign of lack of continuity in the larval phases or metamorphosis. The life-cycle of *L. sericata* can therefore definitely be given. The average time from hatching of the eggs to the end of the feeding period of the larvae is 3 days; the average pre-pupal life, 3 days; the pupal stage, 8 days. As oviposition takes place from the 8th day of adult life, the complete life-cycle from egg to egg requires 22 days.

Cousin (G.). **Influence de l'état hygrométrique du milieu sur l'évolution larvaire de** *Lucilia sericata* **Meig.**—*C.R. Soc. Biol.*, ci, no. 24, pp. 913–915, 6 refs. Paris, 1929.

Further experiments have shown that it is possible to produce a condition of diapause in larvae of *Lucilia sericata*, Mg., by varying any one of the essentials of the environment. Former investigators have recorded that progressive deprivation of water (anhydrobiosis) causes a retardation of development in various insects; in the case of *L. sericata* this is generally followed by a diapause. In the case of larvae fed on fresh meat which was renewed each day, but without moisture to compensate for the loss by evaporation in the cages, which were maintained at a temperature of 33° C. [91·4° F.], the feeding period was generally prolonged and the growth of the larvae slower. A few (2–10 per cent.) pupated after a pre-pupal period of 4 to 6 days, that is, in about double the normal time; 15–20 per cent. pupated after 6 to 20 days. If the conditions were maintained, the remaining larvae soon died, but if removed on the 20th day to dry sand at a lower temperature, they lived for 2 or 3 months. Somewhat similar results were obtained with older or mature larvae. Larvae reared in normal conditions until fully grown and then kept in a glass receptacle in an atmosphere saturated with water never pupated. They remained active for several weeks, but after that time all gradually died. The amount of water absorbed by larvae of *L. sericata* in the course of their development is therefore an essential factor in the process of metamorphosis; anhydrobiosis during the entire or part of the larval life or a permanent excess of moisture has the result of preventing metamorphosis.

Dinulescu (G.). **Sur la ponte du** *Gastrophilus pecorum*.—*Ann. Paras. hum. comp.*, vii, no. 4, pp. 287–289, 2 figs. Paris, 1st July 1929.

Up to the present no definite information on the site chosen for oviposition by *Oestrus* (*Gastrophilus*) *pecorum*, F., appears to have been obtained, but the author found, on examining material from rearing experiments, that eggs had been laid on two pupae of the same species that had failed to emerge. He therefore concludes that eggs are laid on forage or objects in stables or in the vicinity of horses, so that

the young larvae can be introduced by the mouth into the digestive tract of the animal. No eggs were found on the hundreds of horses examined. The number of eggs found in three dissected females varied from 2,343 to 2,560, the great quantity compensating for the risks to which the young larvae are exposed. Descriptions are given of an egg dissected from the female and of one laid on a pupal case.

MOTE (D. C.). **The Ox Warble Flies, *Hypoderma bovis* de Geer, *Hypoderma lineatum* de Villers.**— *Bull. Ohio Agric. Expt. Sta.*, no. 428, 45 pp., 12 figs., 46 refs. Wooster, Ohio, November 1928.

Cattle in Ohio are subject to attack by *Hypoderma bovis*, DeG., and *H. lineatum*, Vill., which cause considerable annual losses. Investigations on their bionomics and control were carried out from 1913 to 1918, and this paper is a report on these studies, incorporating also the more salient features of recent literature [*R.A.E.*, B, xiv, 163, etc.]. Some further records of infestation in horses are given. The characters by which all stages of the two flies may be distinguished are described.

PAPERS NOTICED BY TITLE ONLY.

DAVIS (N. C.), LOBO (M. N.) & CABARROU (F. G.). **Lucha antipalúdica en Medinas. Relación preliminar despues de un año de trabajo.** [Anti-malarial Campaign at Medinas. Preliminary Report after the first Year's Work.]—*An. Dept. nac. Hig.*, xxxii, pp. 13–35 (j), 27 figs. Buenos Aires, 1926. [See *R.A.E.*, B, xvi, 10.]

BROOKE (G. E.). **Adult Culicines: Dichotomous Table of the Household biting Pests of Tropical Asia.**—*Malayan Med. J.*, iv, no. 2, pp. 77–78. Singapore, June 1929.

DYAR (H. G.). **A new Mosquito from the Philippine Islands.**—*Proc. Ent. Soc. Wash.*, xxxi, no. 3, pp. 61–62. Washington, D.C., March 1929.

VAN THIEL (P. H.). **Sur l'origine des variations de taille de l'*Anopheles maculipennis* dans les Pays-Bas.**—*Acta Leidensia Scholae Med. trop.*, iii, pp. 309–336, 13 refs. Leyden, 1928. [See *R.A.E.*, B, xv, 180.]

VAN THIEL (P. H.). **Die holländischen Malariamücken.** [The Dutch Malaria Mosquitos.]—*Acta Leidensia Scholae Med. trop.*, iii, pp. 337–344, 11 refs. Leyden, 1928. [See *R.A.E.*, B, xvii, 108.]

ADOWA (A. N.) & SEBENZOW (B. M.). **Ergebnisse der 3-jährigen Tätigkeit der hydrobiologischen Abteilung in der Erforschung der Ökologie der Anopheleslarven an den Torfgewinnungsstellen.** [Results of 3 Years' Activity of the Hydrobiological Division in the Investigation of the Ecology of *Anopheles* Larvae in Turf Pits.]—*Z. angew. Ent.*, xv, no. 1, pp. 170–177, 22 refs. Berlin, May 1929. [See *R.A.E.*, B, xvi, 218.]

MEDSCHID ( ). **Interessante Varianten der Fühlerschafthaare und Kiemenbei den *Ornatus*- und *Echinus*-Larven.** [Interesting Variations of the Antennal Hairs and Gills in the Larvae of *Aëdes geniculatus*, Ol. (*ornatus*, Mg.) and *A. echinus*, Edw.]—*Arch. Schiffs- u. Tropenhyg.*, xxxiii, no. 7, pp. 400–401, 1 fig. Leipzig, July 1929.

DYAR (H. G.). **The present Knowledge of the American Species of** *Phlebotomus* **Rondani (Diptera, Psychodidae).** [1 new Subgenus, 2 new Species; Key to the Males.]—*Amer. J. Hyg.*, x, no. 1, pp. 112–124, 4 figs. Baltimore, Md., July 1929.

YOUNG (C. W.), HERTIG (M.) & LIU (P.-Y.). **The Kala Azar Transmission Problem : Field and Laboratory Studies in China. II. Susceptibility of various Rodents to Infection with** *Leishmania donovani*.—*Amer. J. Hyg.*, x, no. 1, pp. 183–200, 9 refs. Baltimore, Md., July 1929.

KRÖBER (O.). **Die Ausbeute der deutschen Chaco-Expedition 1925-26 (Diptera). XIII. Tabanidae.** [7 new Species.]—*Konowia*, viii, no. 2, pp. 174–193, 2 pls. Vienna, 25th June 1929.

[DRYENSKI (P.).] DRENSKY (P.). **Blutsaugende Fliegen aus der Familie der Tabanidae (Bremsen) in Bulgarien.** [*In Bulgarian.*]—*Mitt. naturw. Inst. Sofia*, ii, pp. 55–128, 12 figs., 21 refs. Sofia, 1929. (With a Summary in German.)

FOX (C.). **Some new Siphonaptera.**—*Ent. News*, xl, no. 7, p. 218. Philadelphia, Pa., July 1929.

SCHULZE (P.). **Ein neuer deutscher Haustaubenparasit,** *Ixodes caledonicus sculpturatus*. [A new Parasite of the Domestic Pigeon in Germany, *Ixodes caledonicus sculpturatus*, subsp. n.]—*Sitz Ber. naturf. Ges. Rostock*, (3) ii (1927–28), reprint 6 pp., 2 figs., 4 refs. Rostock, 1929.

IMES (M.). **Hog Lice and Hog Mange. Methods of Control and Eradication.**—*Fmrs.' Bull. U.S. Dept. Agric.*, no. 1085, revd. edn., 22 pp., 10 figs. Washington, D.C., January 1929. [See *R.A.E.*, B, viii, 200 ; xii, 49.]

[BARUIKIN (V.), ZAKHAROV (A.), KOMPANEETZ (A.) & BARUIKINA (O.).] BARYKIN (W.), ZACHAROFF (A.), KOMPANEETZ (A.) & BARYKIN (O.). **Untersuchungen über das Fleckfieber. II. Mitteilung : Das Fleckfieber bei Kleiderläusen.** [Investigations on Typhus Fever. II. Typhus Fever in Clothes Lice (*Pediculus humanus*, L.).]—*Zbl. Bakt.* (1) Orig., cxii, no. 1–2, pp. 25–32, 5 charts, 6 refs. Jena, 10th May 1929. [See *R.A.E.*, B, xvi, 264.]

[YAKIMOV (V. L.) & RASTEGAEVA (E. F.).] YAKIMOFF (W. L.) & RASTEGAIEFF (E. F.). **L'essai de l'infection des bovidés avec le** *Françaiella colchica* **par les tiques.**—*Zbl. Bakt.*, (1) Orig., cxii, no. 1–2, pp. 69–73. Jena, 10th May 1929. [*Cf. R.A.E.*, B, xvii, 79.]

BAU (A.). **Versuch einer Teilung der Gattung** *Cuterebra* **(Diptera, olim Oestridae) in vier Untergattungen.** [An Attempt to divide the Genus *Cuterebra* into four Subgenera.]—*Centralbl. Bakt.*, (2) lxxvii, no. 25–26, pp. 542–544, 1 fig. Jena, 27th April 1929.

HEGNER (R.). **The Viability of Paramecia and Euglenae in the digestive Tract of Cockroaches** [*Periplaneta americana*, L.].—*J. Parasit.*, xv, no. 4, pp. 272–275, 6 refs. Urbana, Ill., June 1929.

CHORINE (V.). **Immunité antitoxique chez les chenilles de** *Galleria mellonella*.—*Ann. Inst. Pasteur*, xliii, no. 7, pp. 955–958. Paris, July 1929.

Bishopp (F. C.), Laake (E. W.) & Wells (R. W.). **Cattle Grubs or Heel Flies with Suggestions for their Control.**—*Fmrs'. Bull. U.S. Dept. Agric.*, no. 1596, 22 pp., 19 figs. Washington, D.C., June 1929.

This is a shorter and more popular account of the bionomics and control of *Hypoderma lineatum*, Vill., and *H. bovis*, DeG., on cattle in the United States than one already noticed [*R.A.E.*, B, xiv, 163].

Marcovitch (S.). **Sodium Fluosilicate as a House-fly Poison.**—*J. Econ. Ent.*, xxii, no. 3, p. 602. Geneva, N.Y., June 1929.

As a measure against *Musca domestica*, L., in a laboratory, dishes containing a saturated solution of sodium fluosilicate were placed near the windows. There was no water available, and the flies drank readily of the solution and died within 30 minutes. If the water is renewed, a solution of this powder should last for a long time.

Simmonds (H. W.). **Introduction of *Spalangia cameroni*, Parasite of the Housefly, into Fiji.**—*Agric. J. Fiji*, ii, no. 1, p. 35. Suva, 1929.

Three consignments of *Spalangia cameroni*, Perk., have been received in Fiji from Hawaii, where it breeds in the puparium of the horn-fly [*Lyperosia irritans*, L.], to control the house-fly [*Musca* sp.], and over 6,000 individuals have so far been liberated. In Fiji it is being successfully reared in both house-fly and Sarcophagid puparia; the larvae of these flies both occur in cow dung, but the former generally leaves it to pupate in the soil, whereas the latter pupates in the dung itself. The horn-fly also breeds entirely in dung, and owing to this difference in habit between it and the house-fly, it seems probable that the parasite will find difficulty in reaching a large percentage of house-fly pupae and that predators [*cf. R.A.E.*, B, xvi, 254] and a larval parasite will be required for the successful control of it.

Sur (S. N.) & Sarkar (H.). **Paris Green as an Anopheline Larvicide.**—*Ind. Med. Gaz.*, lxiv, no. 7, pp. 376–378, 4 refs. Calcutta, July 1929.

As a result of the study of previous investigations and of experiments carried out in Bengal, it was found that Paris green as an Anopheline larvicide has the advantages of being inexpensive, odourless and so slightly soluble in water that it has no effect on the usual aquatic fauna; moreover, it is equally effective in weedy or clear water. Its disadvantages are that it does not kill either eggs or pupae of Anophelines and has no effect on Culicines; that a fresh application is necessary after a shower of rain or high wind immediately following dusting; that it may be useless in streams with a strong current; and that, although it is not noxious to animals, there is considerable prejudice against its use in tanks used for drinking water.

Rao (G. R.). **Myiasis in Lepers.**—*Ind. Med. Gaz.*, lxiii, no. 4, pp. 201–202; lxiv, no. 7, pp. 380–382. Calcutta, April 1928 & July 1929.

Four cases of myiasis in lepers in India are described. In one of the two cases of infestation of the nasal cavities, a larva was reared to the adult stage and proved to be *Musca domestica*, L. It is suggested

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the flies may have been attracted by the discharges that were present in both cases, and entered the nose during sleep to deposit their eggs in the ulcers. In one case of myiasis of wounds, the fly concerned belonged to the genus *Sarcophaga*, and in the second case larvae of both *Sarcophaga* and *M. domestica* were found in the same patient. The difficulty of obtaining living larvae and of rearing them to the adult stage was found to be considerable.

STRICKLAND (C.). **A Case of Myiasis of a Carious Tooth.**—*Ind. Med. Gaz.*, lxiv, no. 7, p. 386, 1 fig. Calcutta, July 1929.

A case of dental myiasis caused by the larvae of *Chrysomyia bezziana*, Villen., is described. Presumably the fly was attracted by the odour of putrefaction arising from a decayed tooth and deposited its eggs while the patient slept with his mouth open. This is believed to be the first case of its kind recorded.

NIESCHULZ (O.). **Zoologische Beiträge zum Surraproblem Nr. 23. Zusammenfassung der Ergebnisse einiger Surraübertragungsversuche auf Java und Sumatra.** [Zoological Contributions to the Problem of Surra. No. 23. Résumé of the Results of some Experiments in Java and Sumatra on the Transmission of Surra.]—*Arch. Schiffs- u. Tropenhyg.*, xxxiii, no. 5, pp. 257–266, 23 refs. Leipzig, May 1929.

This is a review of the results of experiments in transmitting surra with large numbers of different insects, which have already been noticed [*R.A.E.*, B, xiv, 102 ; xv, 191, 211 ; xvi, 82, 108 ; xvii, 49, 92].

NIESCHULZ (O.). **Zoologische Beiträge zum Surra Problem.**

XXV. Ueber den Einfluss verschiedener Versuchstiere auf das Ergebnis von Surraübertragungsversuchen mit *Stomoxys calcitrans*. [Notes on the Influence of various Laboratory Animals on the Results of Surra Transmission Experiments with *Stomoxys calcitrans*.]

XXVI. Uebertragungsversuche mit *Tabanus rubidus* **Wied. nach längeren Intervallen.** [Transmission Experiments with *Tabanus rubidus*, Wied., after moderately long Intervals.]—*Zbl. Bakt.* (1) Orig., cxiii, no. 1–2, pp. 80–93, 15 refs. Jena, 8th July 1929.

An account is given of numerous experiments in the transmission of surra made with over 3,600 examples of *Stomoxys calcitrans*, L., in which horses, monkeys, rabbits, guineapigs, rats and mice were used both as the source of infection and as the animal to be infected. It was demonstrated that whereas the species of animal to be infected may exercise a decisive influence on the result of the transmission, the species from which infection is obtained is of little importance. Horses are more difficult to infect than the small laboratory animals whatever the animal from which infection is obtained. The prospects of successful infection in the tests were 1 : 1,150 in the case of horses ; 1 : 23–1 : 27 in rabbits, guineapigs and rats ; and 1 : 55 in mice.

Further experiments confirm the general belief that no development of the trypanosomes occurs in Tabanids [*R.A.E.*, B, xvi, 109]. Only negative results were obtained in two experiments in which large numbers of *Tabanus rubidus*, Wied., previously fed on infected horses, were allowed to feed after an interval of 1–84 days 7,434 times

in all on healthy ones. The contents of the digestive tract of lots of 100 *T. rubidus* removed 15 and 30–31 days after the feeding of the flies on the infected horses were not infectious when subcutaneously injected into healthy ones.

JACK (R. W.). **Tsetse Fly.**—*Rep. Secy. Dept. Agric. S. Rhodesia 1928*, pp. 41–44. Salisbury, 1929.

The area in the Lomagundi district that was formerly infested with tsetse-fly [*Glossina morsitans*, Westw.] [*R.A.E.*, B, xvi, 15, 257] is now considered to be as free as it is possible to make it, though the flies are present in numbers immediately north of the old north (now the middle) fence, and are undoubtedly carried in occasionally by travelling natives and vehicles from the fly area. The improvement recorded in 1927 on the farms previously affected has been more than maintained, and on the whole the position is considered encouraging. Direct inspection during the past two years indicates appreciable retrogression of the fly, uncontrolled traffic being the main obstacle in clearing up infestation. In the Gatooma sub-district new fences were erected in April, and definite improvement of the former heavy infestation cannot be expected as yet. Grass burning in the Lomagundi area was carried out on 29th September, but the result was even less encouraging than in the previous year, the effect on puparia and the density of adult flies being apparently negligible. The direct effect only has been observed, experiments on a large enough scale to determine the indirect effects of burning cannot at present be made. Progressive decrease in the density of the fly during the dry season was again noted; the cause is obscure, and it is apparently not due to parasites.

An attempt was made to cut evergreen trees along the Gwaai River with a view to creating a barrier against encroachment of the fly; this, however, was discontinued, and it is now proposed to establish settlements along the banks on the basis of free occupation of farms. North of the Gwaai-Shangani junction, the fly is spreading towards the Gwaai River, both fly and game having notably increased since 1923.

Tsetse-flies recorded close to the Melsetter border include *G. brevipalpis*, Newst., *G. pallidipes*, Aust., and *G. morsitans*. Only one individual of the last-named has been captured, but it is the first record of the species from that locality; examination will determine whether it has become established there, as it is considered to constitute the greatest menace of invasion of the southern part of Rhodesia from Portuguese East Africa. Many cattle were reported to have died of trypanosomiasis on farms south of the Lusitu River. The Sabi River Valley is a probable haunt of tsetse-fly and is to be examined on that account.

A search for parasites has revealed as yet only two minor parasites common to *Glossina* and allied species. Plans are being discussed by which it is hoped to create barriers against tsetse-fly encroachment by means of concentration of natives and by European settlement.

BUCHANAN (J. C. R.). **Note on the Trypanosome Infection Rate of Wild Game.**—*Kenya & E. Afr. Med. J.*, vi, no. 4, pp. 111–113, 6 refs. Nairobi, July 1929.

Microscopical examination of the peripheral blood of 150 head of various species of game and larger vertebrates in the Rukwa valley,

a locality of Tanganyika Territory that is an endemic centre of Rhodesian sleeping sickness and is infested with *Glossina morsitans*, Westw., showed that 31, or 20·6 per cent., were infected with trypanosomes, which in 18 cases (or 58 per cent. of the positive findings) were probably *Trypanosoma brucei*. This relatively high percentage appears to be due to the inclusion of a large number of waterbuck, the most common of the larger antelope found in close proximity to the settlements, since more than 50 per cent. of these animals harboured trypanosomes.

AUSTEN (E. E.). **The Tsetse-fly Parasites belonging to the Genus *Thyridanthrax* (Diptera.—Family Bombyliidae), with Descriptions of new Species.**—*Bull. Ent. Res.*, xx, pt. 2, pp. 151–164, 10 figs., refs. London, August 1929.

A key is given to the seven species of the Bombyliid genus *Thyridanthrax* that parasitise the pupae of tsetse-flies, *viz.*, *T. lloydi*, Aust., recorded from Northern Nigeria, *T. salutaris*, sp. n., from Nyasaland, *T. argentifrons*, sp. n., from Northern Nigeria, *T. abruptus*, Lw. (*lugens*, Lw.) from Natal, Southern Rhodesia, Northern Rhodesia, Nyasaland, Uganda, Kenya and Abyssinia, *T. transiens*, Bezzi, from Nyasaland, Southern Rhodesia and Kenya, *T. lineus*, Lw., from Eritrea, Kenya, Nyasaland, S. Rhodesia and Natal, and *T. beneficus*, sp. n., from Portuguese East Africa. None of these parasites is known to attack any species of *Glossina* other than *G. morsitans*, Westw., except *T. argentifrons*, which was bred from *G. tachinoides*, Westw., and *G. morsitans submorsitans*, Newst.

MARSHALL (J. F.) & STALEY (J.). **The Graphical Representation of Instar Records in a Regional Mosquito Survey.**—*Bull. Ent. Res.*, xx, pt. 2, pp. 195–198, 2 figs. London, August 1929.

Reproductions are given of the type of chart used at the British Mosquito Control Institute for the graphic representation of the species and instars of mosquitos collected throughout the various months of the year, to which is attached a chart showing the local daily rainfall. Symbols on the charts refer to notes of special interest recorded in the daily register, specimens of such entries being shown in a table. A second table shows the association records of mosquitos collected during the year, with notes on the salinity and pH of the water in which they were found.

DE AZEVEDO MARQUES (L.). **Mosquitos transmissores de doenças infecciosas. Seus habitos e os meios de combatel-os.** [The Mosquitos that transmit infectious Diseases. Their Habits and the Means for combating them.]—*Bol. Minist. Agric. Ind. Comm.*, xviii (i), no. 5, pp. 665–688, 24 figs., 4 refs. Rio de Janeiro, May 1929.

This is a popular account of the bionomics and control of mosquitos, with brief notes on their relation to disease, much of the information being taken from the literature.

Godoy (A.) & Botafogo Gonçalves (N.). **Communicação apresentada á Sociedade Brasileira de Biologia (Sessão de 24-iv-929).**—*Suppl. Mem. Inst. Oswaldo Cruz*, no. 7, p. 100, 2 figs. Rio de Janeiro, May 1929.

A brief description is given of two traps for the yellow fever mosquito [*Aëdes argenteus*, Poir.]. They contain water on which the mosquitos oviposit, but are so arranged that when the resulting larvae reach the adult stage, they are unable to escape.

de Beaurepaire Aragão (H.) & da Costa Lima (A.). **On the Transmission of the Virus of Yellow Fever by the Excreta of infected Mosquitos.**—*Suppl. Mem. Inst. Oswaldo Cruz*, no. 8, pp. 101–108, 1 pl. Rio de Janeiro, 22nd June 1929. (In Portuguese and English.)

Droplets of clear fluid are always ejected by *Aëdes argenteus*, Poir. (*aegypti*, L.) through the anus immediately following the withdrawal of its proboscis after feeding. Monkeys (*Macacus rhesus*) were infected with yellow fever by the injection of dilutions of these droplets obtained from infected mosquitos. In an additional note, the authors state that they subsequently infected monkeys by placing the diluted droplets on the conjunctiva or on the skin.

Philip (C. B.). **Preliminary Report of further Tests with Yellow Fever Transmission by Mosquitoes other than** *Aëdes aegypti*.—*Amer. J. Trop. Med.*, ix, no. 4, pp. 267–269, 3 refs. Baltimore, Md., July 1929.

Continued investigations have proved that three further Nigerian species of *Aëdes* can transmit yellow fever to *Macacus rhesus* [*cf. R.A.E.*, B, xvi, 235]. *Aëdes vittatus*, Big., is a semi-domestic species that prefers rain-holding depressions in rocks and masonry for breeding purposes, though the larvae have been recorded from buckets, roadside puddles, etc. It bites and breeds readily in confinement. Six normal monkeys exposed to the bites of this species at periods varying from 11 to 39 days after feeding on an infected animal all contracted yellow fever. *Aëdes africanus*, Theo., does not breed in confinement or feed readily on laboratory animals. It frequents the bush and the outskirts of native settlements, where it breeds in bamboo stumps, but it has been taken engorged with blood in native quarters. Two out of three monkeys exposed to bites of this species 12 to 21 days after the infective feed died of yellow fever. *Aëdes simpsoni*, Theo., breeds infrequently in tree-holes in the vicinity of Lagos, but becomes more common towards the interior. It feeds more readily in the laboratory than any of the other species of *Aëdes* except *A. argenteus*, Poir. (*aegypti*, L.) and possibly *A. vittatus*. Three normal monkeys were infected by it 19, 24 and 30 days after the infective feeds. The disease has also been transmitted by the injection of emulsions of each of these three mosquitos.

MATHESON (R.) & HINMAN (E. H.). **Further Studies on *Chara* spp. and other Aquatic Plants in Relation to Mosquito Breeding.**—*Amer. J. Trop. Med.*, ix, no. 4, pp. 249–266, 5 figs., 10 refs. Baltimore, Md., July 1929.

In further observations on the effect of *Chara* on mosquito development [*cf. R.A.E.*, B, xvi, 141], tests with various species of *Aëdes* showed that in small aquaria in which *Chara fragilis* maintained a vigorous growth practically no larvae reached maturity. A series of small aquaria containing *Chara fragilis* was set up in an open greenhouse to test whether various species of *Culex* and *Anopheles* would oviposit in them. Wherever the *Chara* was decaying or dying, oviposition took place almost immediately, but where it maintained a vigorous growth no oviposition was observed, and introduced larvae of *Culex apicalis*, Adams, all died within a short time. Where considerable decay of the *Chara* took place at the beginning of the experiments, most of the larvae from the first egg masses matured, but those hatching from egg masses deposited when the *Chara* was regaining vigour usually failed to mature. Where no growth of *Chara* was obtained, breeding took place throughout the season.

A second series of experiments, conducted with ordinary wooden tubs with their tops level with the surface of the ground and well protected from winds, showed results similar to those obtained in the first series. In the tubs that did not contain *Chara*, the addition of milk brought about a great increase in oviposition and larval development, but the addition of sugar caused a lowering of the pH and the cessation of breeding. In troughs the growth of *Chara* was more satisfactory, and the results were even more conclusive. Out of 400 larvae of *Culex* spp. and *Aëdes vexans*, Mg., only 3 adults emerged, and in a section divided off by wire screens overlaid with cheesecloth and containing no *Chara* only 43 adults emerged from 400 larvae. In a similar tank containing running water the *Chara* appeared to be equally effective. No natural breeding took place in the troughs.

A limited survey of a small portion of the central New York area showed that in all lakes, ponds and streams where *Chara* grew vigorously no mosquito breeding took place, except in the case of a spring-fed pool with a vigorous growth of *Chara* from which larvae of *Anopheles punctipennis*, Say, were taken in some numbers, a possible explanation being that there was extensive decay going on in and around the *Chara*.

Early in spring a large number of introductions of *Chara fragilis* were made into a great variety of permanent and temporary pools, marshes, streams, etc., but conclusive results could not be obtained until the following spring. In one case, the development of the larvae was undoubtedly retarded, and during the period of vigorous growth of the *Chara* no breeding took place. In early July a considerable area of decay appeared, and breeding began again and continued until the end of the season.

During 1927 weekly examinations of the plankton in the pool containing *Chara fragilis* [*loc. cit.*] and a typical woodland pool where mosquitos bred in abundance showed a much greater variety and density of plankton organisms in the former. The same result was obtained in aquaria. There was no obvious difference in the bacterial contents of the experimental aquaria. Initial experiments in 1927 indicated that *Phyllotria* (*Elodea*) *canadensis* is also inimical to mosquito breeding. Three experiments in aquaria showed it to be highly toxic

to the larvae, and no natural breeding occurred although the aquaria were exposed for practically the entire summer. Limited experiments carried out with species of *Spirogyra*, *Oedogonium* and *Zygnema* showed that these algae maintained an even higher pH than *Chara* or *Phyllotria* [*cf. loc. cit.*], and of some 1,250 larvae of *Culex* and *Aëdes* introduced only about 10 per cent. produced adults, though the very high temperatures prevailing at that time may have accounted for the excessive death rate.

Recent research on factors that favour or inhibit mosquito breeding is briefly reviewed, and it is suggested that much of the larval food may be obtained from organic substances in solution. It is also pointed out that the excessive amount of oxygen given off by the plant may be a factor in the prevention of larval development in pools containing *Chara*, possibly in some way inhibiting decay and oxidising organic substances in solution, thereby rendering this type of food unavailable for the mosquito larvae. Moreover, the dissolved oxygen may interfere with digestive processes of the larvae.

Cooley (R. A.) & others. **Work done by the Entomological Department. Control of Mosquitoes.**—*34th Ann. Rep. Montana Agric. Expt. Sta. 1926–27*, pp. 90–93. Bozeman, Mta. [1928.]

Up to the present, 37 species of mosquitos have been found in Montana, where they are serious agricultural pests, causing loss of condition in cattle and sometimes diminishing milk production by 30–40 per cent. Normally one brood of mosquitos occurs after the flood waters and rains of May and June, but where irrigation is practised, additional broods appear with each successive application of water to areas suitable for oviposition. During warm weather, adults emerged 8 days after irrigation and larvae could be seen 6 hours after grass-land had been flooded. If, therefore, the water is efficiently drained from the fields within 3 or 4 days, the numerous larvae will be destroyed. Breeding pools that cannot be drained should be treated with oil whenever larvae are present. A number of repellents for the use of persons in the field were tested, but the protection afforded proved temporary. A mixture of equal parts of citronella oil with some oil that is non-irritating to the skin, such as olive oil, was as effective as any.

Parker (J. R.) & Mabee (W. B.). **Montana Insect Pests for 1927 and 1928. The Twenty-second Report of the State Entomologist of Montana.**—*Bull. Montana Agric. Expt. Sta.*, no. 216, 23 pp., 5 figs. Bozeman, Mta., December 1928.

In Milk River Valley, Montana, where mosquitos are a major pest from an agricultural point of view, the species mainly responsible are *Aëdes spenceri*, Theo., *A. nigromaculis*, Ludl., *A. vexans*, Mg., and *A. dorsalis*, Mg. During May 1927 the rainfall was excessive (7·46 inches) and produced flooded conditions that rendered control practically impossible. On the other hand, May 1928 was excessively dry (0·26 inches), and irrigation, which is not normally begun until July, was necessary on a large scale and resulted in the production of mosquitos

that would not ordinarily have emerged until the latter month. The rainfall during June of both years was very nearly normal, though mosquitos were more than usually abundant owing to the abnormal conditions in the preceding months of May. The normal rainfall for July is 1·73 inches, but in spite of the fact that 3·67 inches fell in 1927, it was fairly evenly distributed and control work was partly successful. On the other hand, a precipitation of 5·17 inches in July 1928, of which 2·4 inches fell in two hours, produced flooded conditions that distributed the larvae from the pools and irrigation ditches to practically every place where standing water could be found, and made control work impossible.

HEADLEE (T. J.), MILLER (F. W.) & GINSBURG (J. M.). **Mosquito Control.**—*Rep. New Jersey Agric. Expt. Sta. 1927–28*, pp. 177–189, 2 figs. New Brunswick, N.J., 1929.

Much of the information in this report has already been noticed [*R.A.E.*, B, xvii, 136–140]. A brief résumé is given of the activities of the mosquito commissions in the different counties of New Jersey. Climatic conditions in 1927 were very favourable to mosquito breeding, but unceasing efforts resulted in keeping the numbers to a fair minimum in the protected zones. In the southern half of the State, *Aëdes sollicitans*, Wlk., predominated, with *A. vexans*, Mg. (*sylvestris*, Theo.) appearing locally in woodland swamps; in the central and northern sections *A. vexans* caused the greatest trouble. Work on the salt marsh areas resulted in very few generations reaching the winged stage. In the Upper Passiac Valley, several minor floods resulted in the emergence of large numbers of *A. vexans* and *A. canadensis*, Theo.

HEARLE (E.). **The Life-history of *Aëdes flavescens* Müller. A Contribution to the Biology of Mosquitoes of the Canadian Prairies.**—*Trans. R. Soc. Canada*, sect. v, Biol. Sci., xxiii, no. 1, pp. 85–101, 6 pls., 11 refs. Ottawa, January 1929.

In the typical open prairies of Saskatchewan, Manitoba, Alberta and Montana, *Aëdes spenceri*, Theo., *A. lutescens*, F. (*flavescens*, auct.), *A. dorsalis*, Mg., and *A. campestris*, D. & K., are common, and *A. nigromaculis*, Ludl., though occurring less frequently, is troublesome in some of the more arid districts. These mosquitos breed in snow pools and may occur in highly alkaline waters. *A. excrucians*, Wlk., *A. riparius*, D. & K., and *A. fitchi*, F. & Y., are common in the poplar savannah, and the last named also breeds in open prairie pools. Other common and generally distributed species are *Culex tarsalis*, Coq., *Theobaldia inornata*, Will., and *Anopheles maculipennis*, Mg., the last two attacking animals in preference to man. *Aëdes vexans*, Mg., is abundant in some districts.

A. lutescens, all stages of which are described, while attacking man freely, appears to prefer the larger mammals. The larvae occur in large prairie pools containing considerable vegetation, hibernation taking place in the egg stage. An account is given of observations on the resistance of the eggs to desiccation and the factors that stimulate hatching. The larval and pupal periods vary considerably, but in normal conditions they occupy 6–7 weeks. Freezing of the breeding

pools does not appear to destroy the larvae. The adults, which occur from June to August, fly by day, but are most active at dusk. They are not attracted to light. During 1926 and 1927 the peak of the egg-laying period was the first week in July.

Dytiscid larvae were observed feeding greedily on the larvae, and certainly constitute the most important factor in natural control.

HOFFMANN (C. C.). **La Distribución Geográfica de los Mosquitos *Anopheles* en el Estado de Veracruz.** [The Geographical Distribution of *Anopheles* in the State of Veracruz.]—76 pp., 25 pls., 3 maps, 10 refs. Mexico, Dept. Salubridad publica, 1929.

This paper is based on observations made in the hot zone of the Mexican state of Veracruz in 1926–27. This zone is situated between 18 and 22° N. lat. at an altitude of less than 3,000 ft. Of the 10 species of *Anopheles* found, a key to which is given, *A. albimanus*, Wied., *A. argyritarsis*, R.-D., *A. vestitipennis*, D. & K., *A. punctimacula*, D. & K., *A. apicimacula*, D. & K., and *A. cruzi*, D. & K., which require moisture, and *A. pseudopunctipennis*, Theo., which is adapted to a more or less dry climate, are southern species; *A. punctipennis*, Say, *A. crucians*, Wied., and *A. quadrimaculatus*, Say, are North American species requiring a dry climate. There exist in this zone regions of permanent mosquito activity, characterised by periodical changes in the specific and numerical composition of the mosquito population during the year, and by a more or less prolonged hibernation of the females of the southern group requiring moisture [the winter is dry]. There are also regions of temporary activity, in which there is absolute hibernation of the females of all the species.

The distribution and breeding-places of each species are dealt with separately. *A. albimanus* is much the most common in the coastal region during the rainy season, and the most dangerous as a vector of malaria, entering houses more readily than the other species. From March to early November it increases steadily, and then decreases rapidly, almost disappearing in winter. As a rule, the females hibernate completely. It breeds in fresh or brackish water, exposed to the sun, especially if aquatic vegetation is present to protect it against enemies. Towards the end of the rainy season, temporary pools contain vegetation and become intensive breeding-places. *A. pseudopunctipennis* is of little importance in the coastal districts, but in the drier interior it predominates and is the principal and sometimes the sole vector of malaria. *A. quadrimaculatus* does not appear to be so important a vector as in parts of the United States. It occurs in the northern part of the hot zone, and in March 1926 was much the most abundant Anopheline in houses in one locality, though this was not the case later in the year. The females captured indoors, however, were nearly all engorged, and had probably fed on animals.

The conditions as regards the control of Anophelines in the various localities are briefly described, with notes on the anti-larval measures suitable to each. *A. albimanus* is the predominating Anopheline in the port of Veracruz, where *A. pseudopunctipennis* and *A. quadrimaculatus* also occur. At present anti-larval work there is directed chiefly against *Aëdes argenteus*, Poir. (*aegypti*, L.).

[**Report of**] **Bureau of Malaria Control 1926-27.**—*Rep. Comm. Hlth. Porto Rico 1926–27*, pp. 62–95. San Juan, P.R., 1929.

Parts of this report have already been noticed [*R.A.E.*, B, xvi, 209, 239], but it is now clear that the statements contained in the second part (which were taken from an abstract) refer only to one district of Porto Rico and not to the Island as a whole. The advantages of tide gates are discussed. There are so many lowlands that are only slightly above low tide level that if some arrangement is not made to keep out the high tides, the fields are continuously flooded during the months of highest tides and greatest rains. Pumps are not as a rule feasible for rural districts or small communities, but by the use of tide gates it has been possible under ordinary conditions to restrict the water for the greater part of the time to the main canals, where Paris green can be easily applied if necessary. In mangrove swamps when the water is shallow it soon becomes foul, and so long as fresh water is kept out by gates, conditions are very unfavourable for the breeding of Anopheline larvae. Old leaky wooden irrigation canals are gradually being replaced by improved ones of metal or concrete. Where Paris green is applied at weekly intervals, it is possible for larvae of *Anopheles albimanus*, Wied., to reach maturity between applications, a fact that largely accounts for the numbers occurring in places where control measures are carried out. The incidence of malaria in various localities is discussed.

An account is given of investigations made to determine the durability of various materials for screening and to test the amount of obstruction to wind caused by them. The greatest obstruction was caused by the heavier grades of wire and by the cloth screen, but for these regions the light grades of galvanised wire are not recommended. It is probable that a ·015 inch galvanised wire will last as long as a ·009 copper wire and that a 16 mesh would keep out as small an insect as an 18 mesh of the finer wire. In Porto Rico there is no indication that anything finer than 16 mesh is necessary, and in the heavier wire a 14 mesh would probably be sufficient. The small biting flies seem to be able to traverse anything that air will pass through. If copper or bronze is used, the wire should have a diameter of at least ·012, or better still ·015, especially for doors and windows, where it is exposed to heavy wear.

MARTINI (E.). **Zur Technik der Dauerpräparate von Culicidenlarven.** [Technique for the permanent Preparation of Mosquito Larvae.]—*Riv. Malariologia*, viii, no. 3, pp. 303–304. Rome, 1929. (With Summaries in Italian, p. 350, French, p. 352, English, p. 354, German, p. 356.)

The larvae are taken from water or alcohol and placed in a watch-glass, where they are covered with a few cubic centimetres of a warm mixture of 1 part unthickened cedar wood oil and 9 parts absolute alcohol. The temperature must be 70° C. [158° F.]. After cooling, the glass is placed, together with a dish containing sulphuric acid for drying the air, under a glass cover. After about 24 hours the oil is replaced by pure cedar oil. A few hours later the larvae can be placed on the slide and sealed with Canada balsam. Even larvae that have been kept in alcohol for a long time can generally be satisfactorily dealt with in this manner.

Brighenti (D.). **Contributo allo studio dell' *Anopheles sacharovi* Favr.** [A Contribution to the Study of *A. sacharovi*.]—*Riv. Malariologia*, viii, no. 3, pp. 305–309, 7 refs. Rome, 1929. (With Summaries in Italian, p. 350, French, p. 352, English, p. 354, German, p. 356.)

As a result of breeding experiments with *Anopheles sacharovi*, Favr, the author suggests that this species is subject to seasonal dimorphism. In summer it is true to type, but in autumn and winter a large number of individuals resemble *A. maculipennis*, Mg. This seems to explain the apparent disappearance of *A. sacharovi* in the region of Ferrara in winter.

Guelmino (D.). **Beitrag zur Epidemiologie der Malaria in Mazedonien.** [A Contribution to the Epidemiology of Malaria in Macedonia.]—*Arch. Schiffs- u. Tropenhyg.*, xxxiii, no. 8, pp. 423–430, 2 figs. Leipzig, August 1929.

In view of the recorded occurrence of Anophelines and malaria in Serbian Macedonia [*cf. R.A.E.*, B, xii, 148, 192; xiv, 57; xv, 122; xvi, 95], it is concluded that the inactive period of the mosquitos (October–April) is long enough to allow many of the infected persons to become free from infection, so that the spring epidemic of benign tertian consists mainly of new infections [but *cf.* xv, 122]. Variations in the development and abundance of the mosquitos are reflected in the variation of the incidence of benign tertian malaria.

The epidemic of malignant tertian begins at the end of summer, four months after the mosquitos become active, and continues in the autumn; it is mainly due to new infections, and the cause of their late appearance is that the temperature is not high enough earlier in the year to permit the development of infection in the mosquito. The contemporaneous appearance of *A. superpictus*, Grassi, and malignant tertian has led to the assumption that in Macedonia it is the only vector of this form of malaria. But the sudden appearance and wide distribution of malignant tertian in 1927 in July, a month when *A. superpictus* is rare, points to *A. maculipennis*, Mg., being a carrier. Malignant tertian is also widely distributed in the plains, where *A. superpictus* is seldom found.

Markoff (K.) & Moroff (T.). **Zur Kenntnis der Malariamücken in Bulgarien.** [On the Malaria Mosquitos in Bulgaria.]—*Arch. Schiffs- u. Tropenhyg.*, xxxiii, no. 8, pp. 430–432, 4 refs. Leipzig, August 1929.

Existing records on the seasonal and geographical distribution of Anopheline mosquitos in Bulgaria are reviewed, and the authors' observations are given from abundant material from some 150 localities at various seasons. *Anopheles sacharovi*, Favr (*elutus*, Edw.) has been obtained from the Black Sea coast. *A. bifurcatus*, L., was not observed, contrary to existing records; in any case it is of no importance as a vector of malaria in Bulgaria. *A.* (*Myzorhynchus*) *hyrcanus* var. *pseudopictus*, Grassi, may be assumed to occur everywhere on the lower reaches of the Danube. *A. superpictus*, Grassi, and the closely related *A. sergenti*, Theo., occur throughout southern Bulgaria and have been observed in the northern part of the country. They appear in the second half of summer, and in autumn they often completely

replace *A. maculipennis*, Mg., which is predominant earlier in the year, so that they may be held mainly responsible for malignant tertian malaria, which chiefly occurs at the same time.

Sebentzow (B. M.) & Adowa (A. N.). **Die Chemie und Biologie des Wassers der Lehmgruben und die Verteilung der Larven von *Anopheles maculipennis* in ihnen.** [The Chemistry and Biology of the Water in Turf-pits and the Distribution of the Larvae of *A. maculipennis* in them.]—*Arch. Hydrobiol.*, xx, no. 1, pp. 81–87, 2 refs. Stuttgart, 1929.

This is a detailed account of observations made in Russia in the summer of 1926 of two turf-pits of varying age and characteristics in the course of work already noticed [*R.A.E.*, B, xvi, 96]. The old pit had become a completely stabilised pool in which *Anopheles maculipennis*, Mg., bred readily throughout the summer. Although the new pit contained nothing generally or specifically injurious to the larvae, it was usually avoided by ovipositing mosquitos, and larvae were only found in it occasionally. The difference between the electrical conductivity [*cf.* xiv, 33] of the two pits was much greater than that between their salt contents. It must therefore be concluded that the salts of the two pits were different, and that the new pit contained a greater quantity of poor electrolytes, such as silicilic acid and colloidal iron, and a much smaller quantity of other salts essential to the nutrition of plants. In accordance with the chemical characteristics there was also a great difference between the qualitative and quantitative composition of the algae, which in the newer pit were less numerous and varied.

Jaarverslag over de jaren 1927 en 1928 van de Malaria-commissie uit den Gezondheidsraad. [Report for 1927 and 1928 of the Malaria Commission of the Health Council of Holland.]—*Versl. Meded. Volksgezondheid*, May 1929, reprint 33 pp. [Amsterdam, 1929.]

Work against the larvae and adults [of *Anopheles maculipennis*, Mg.] was continued from previous years [*R.A.E.*, B, xv, 202]. The totals of counts in stables and dwellings at Amsterdam are recorded for the years 1920–1928. Some particulars are given relating to investigations at Medemblik [B, xv, 102 ; xvi, 177], where anti-larval work resulted in a considerable reduction in the numbers of mosquitos. In investigating the question of the time spent by mosquitos in one and the same stable, it is necessary to distinguish between stables occupied by animals and unoccupied stables used by the mosquitos purely for shelter. In the former the mosquito density changes little from day to day and males are rare, but in the latter the abundance varies considerably and there are always more than 50 per cent. of males. Various examples are given in support of this.

Swellengrebel (N. H.) & Doornbos (W. H.). **On the so-called "Daily Turnover" of the Anopheline Population in Resting-places and its Bearing on the Evaluation of the Anopheline Incidence to test the Effect of antilarval Measures.**—*Proc. k. Akad. Wetensch.*, xxxii, no. 5, pp. 669–678, 13 refs. Amsterdam, 1929.

The authors use counts of adult Anophelines to indicate the effect of anti-larval measures. In ordinary stables (mostly occupied by pigs)

the Anophelines are killed and counted fortnightly; in specially constructed experimental stables with 4 pigs each, counts (without captures) are made twice a week; and in open, unoccupied outhouses the mosquitos are caught and counted daily. These methods of counting do not appear to influence the abundance of adult mosquitos that would be present normally were catches not made. Experiments described in detail show that in occupied stables it takes 9 days to make good the losses due to captures. Daily catches can be made in unoccupied buildings used by the mosquitos purely as shelters, as there is in these a complete daily change of the mosquito population. Some experiments made with stained individuals are disregarded as being likely to give unreliable information, since the effect of staining on the subsequent movements of the mosquitos is unknown.

SWELLENGREBEL (N. H.), DE BUCK (A.) & SCHOUTE (E.). **On Anophelism without Malaria around Amsterdam. (Third Communication.) On the Food of adult *Anopheles maculipennis* in malarious and non-malarious Regions.**—*Proc. k. Akad. Wetensch.*, xxxii, no. 6, pp. 772–779, 7 refs. Amsterdam, 1929.

Previous papers on the occurrence of Anophelines without malaria in Holland showed the existence south of Amsterdam of a northern malarious area (I) with a short-winged multidentate type of *Anopheles maculipennis*, Mg., and of a southern non-malarious area (II) where a long-winged paucidentate type predominates. These types differ in certain biological characters that prevent transmission of malaria in non-malarious areas during the period of sexual inactivity of the mosquitos (September–March), whereas they greatly favour it in malarious areas [*R.A.E.*, B, xv, 145; xvi, 242]. This does not, however, explain the inferiority as a vector during the height of the malarial season (May–June) of the type prevalent in the non-malarious areas. A study of the feeding habits of the females of both types was therefore made, and it was found that in the malarious area the mosquitos have a higher "domestic blood rate" (percentage of females in houses containing blood of any kind), a higher percentage of females engorged with human blood, and a higher "domestic incidence" (average number of mosquitos in houses). As a result, in the malarious area in the second half of July and in August, the "human blood rate" is treble and the "effective incidence" (average number of females per house containing human blood) is four-fold that in the non-malarious area. These differences are, however, subject to considerable seasonal variation, being well-marked in late summer only, and much less so, or even absent, in early summer. In autumn, when the incidence of infected Anophelines in houses is highest, the "effective incidence" in malarious areas sinks to the level it attained in June, owing to the considerable increase of the "animal blood rate." These differences are most marked when comparing the records of houses with a numerous Anopheline population. Among the factors responsible for these differences, one appears to be a tendency for the mosquitos in malarious areas to remain indoors until the blood has been nearly digested, whereas in non-malarious areas many leave earlier. Another is the early development of the fat-body in mosquitos in non-malarious areas, which reduces the "domestic blood rate." It is concluded that the differences described here

cannot affect the epidemiology of malaria in Holland, as malarial incidence there attains its annual maximum at a period before they become of any consequence.

A comparison between the conditions in Holland and in Italy shows a marked similarity in non-malarious regions. In malarious regions the domestic incidence and the stable incidence offer the most striking differences. In Italy the former is four-fold that in Holland, whereas the latter in Holland is about 200 times as high as in Italy. The higher domestic incidence in Italy is compensated for by a three-fold higher human blood-rate in Holland, so that the effective incidences are about the same.

Schuurman (C. J.) & Schuurman-ten Bokkel Huinink (A.). **A Malaria Problem on Java's South Coast.**—*Meded. Dienst Volksgezondh. Ned.-Ind.*, Foreign edn., xviii, no. 1, pp. 120–142, 5 figs., 1 map, 2 tables. Batavia, 1929.

An account is given of the investigation in 1928 of a locality in East Java in which malaria is epidemic. The great prevalence of the disease appeared to be mainly due to the fluctuating nature of the population, which is able to develop a certain degree of immunity. From 59·5 to 72·9 per cent. of the infections in the three districts investigated were found to be quartan. In one district the only vector occurring was *Anopheles ludlowi*, Theo., which has been considered a poor transmitter of the quartan parasite [*Plasmodium malariae*]. In the other districts the vector was undoubtedly *A. aconitus*, Dön. The probability of a given person becoming infected with malaria in this area is tentatively discussed, and it is shown to be high. In dissections of mosquitos taken, 2 out of 134 examples of *A. ludlowi* and 3 out of 123 of *A. aconitus* were found to be infected with malarial parasites. The other species examined, *A. tessellatus*, Theo. (78 individuals), *A. fuliginosus*, Giles (29), *A. barbirostris*, Wulp. (15), *A. hyrcanus* var. *sinensis*, Wied. (10), *A. vagus*, Dön. (7), *A. subpictus*, Grassi (*rossi*, Giles) (2) and *A. kochi*, Dön. (2), showed no infection. *A. ludlowi* and *A. aconitus* constituted nearly 60 per cent. of mosquitos taken in houses. Other species encountered in the course of this work were *A. schüffneri*, Stanton, and *A. aitkeni*, James. *A. ludlowi* was absent in localities situated at a distance of more than 5 km. [3·1 miles] from its breeding-places, and though present at a spot 4·5 km. distant along a river bed, this species was comparatively less numerous at another point only 2·5 km. distant but separated from the breeding ground by primeval forest. An account is given of a survey of the breeding-places in the affected area. Control measures suggested include the planting of shade trees along rivers to render them unsuitable for the breeding of *A. aconitus*, which shows a preference for sunlight, and dusting brackish swamps with Paris green against *A. ludlowi*. If sufficient funds are available, it is proposed to remove the stones from the river beds and cement them in, in order to eliminate possible breeding-places.

Schuurman (C. J.) & Schuurman-ten Bokkel Huinink (A.). **Application of Paris Green as an *Anopheles*-Larvicide (Second Report).**—*Meded. Dienst Volksgezondh. Ned.-Ind.*, Foreign edn., xviii, no. 1, pp. 143–150, 2 pls., 1 table. Batavia, 1929.

The work of various authors on the use of Paris green in the control of Anopheline larvae is discussed. The best results were secured in

continued experiments at Weltevreden [*R.A.E.*, B, xvi, 216] by the application of a 1 per cent. mixture, with red earth, the preparation of which is described, as the carrier, at the rate of 50 mg. Paris green to the square metre. At this rate the Paris green destroys all the more mature larvae, though the young larvae and pupae are unaffected. A 2 per cent. mixture may be used in cases in which the wind is unfavourable or the number of the larvae abnormally large. The merits of various apparatus used for the application of the dusts in different parts of the world are discussed in detail. The amount of arsenic in ordinary fishpond water, which averages 1–2 mg. to 100 litres, was only increased to 3 or 4 mg. 48 hours after successful dusting. Fish taken from untreated fishponds showed the same arsenic content as those taken from a pond dusted weekly with the usual amount of Paris green.

Essed (W. F. R.). **Malaria at Banjoewangi and the Prospects of an efficient Species Sanitation.**—*Meded. Dienst Volksgezondh. Ned.-Ind.*, Foreign edn., xviii, no. 1, pp. 184–198, 1 pl., 2 maps, 3 refs. Batavia, 1929.

This report of an investigation of malaria at Banjoewangi, a town on the east coast of Java with a population of 23,572, shows that *Anopheles ludlowi*, Theo., breeding in fishponds, was responsible for the epidemic occurring there, whereas *A. aconitus*, Dön., was of little importance. Measures directed against *A. ludlowi* alone can be carried out without difficulty in the fishponds, which have been developed in an old lagoon formed by a combination of meteorological and geological factors. An older lagoon that had been transformed into rice-fields was found to be harmless from the point of view of malaria epidemiology.

Walch (E. W.) & Soesilo (R.). **Annotations from Everywhere about Malaria in the Netherlands Indian Archipelago. I.**—*Meded. Dienst Volksgezondh. Ned.-Ind.*, Foreign edn., xviii, no. 1, pp. 199–207, 3 pls., 6 refs. Batavia, 1929.

These short notes on malaria and its vectors in the Dutch East Indies have been collected during tours made in the course of the last two years. *Anopheles ludlowi*, Theo., was found for the first time in Dutch Borneo, and the range of this mosquito was found to extend as far as Labuan Marege on the series of islands between Celebes and the Lesser Sunda Islands. The form found in Borneo is intermediate between that of the Philippines and var. *sundaica*, Rdnw. [*R.A.E.*, B, xiii, 112]. *A. ludlowi* was also found on Buton, and the larvae were numerous on the north and east coasts of Atjeh, though malaria did not occur there. Stomach dissections indicate that *A. hyrcanus* var. *sinensis*, Wied., is the principal vector of malaria in South Sumatra. *A. umbrosus*, Theo., showed an infection of 5 per cent. on Bangka. At an altitude of 1,200 metres [4,000 ft.], *A. maculatus*, Theo. was found naturally infected for the first time in Java. The occurrence of the larvae of *A. fuliginosus*, Giles, in brackish water was confirmed when this species was found for the first time in Borneo.

KOIDZUMI (M.). **On the Medical Investigations of precautionary Measures against** *Anopheles*. [*In Japanese.*]—*Dobuts. Zasshi* [*Zool. Mag.*], xl, no. 475, pp. 189–198. Tokyo, 1928. (Abstract in *Jap. J. Zool.*, ii, no. 3, p. (105). Tokyo, 1929.)

The author states that in Formosa *Anopheles minimus*, Theo., *A. tessellatus*, Theo., *A. ludlowi*, Theo. (*hatorii*, Koidz.) and *A. lindesayi*, Giles (*pleccau*, Koidz.) show an affinity for *Plasmodium vivax* in the order given; *A. maculatus*, Theo., *A. tessellatus* and *A. lindesayi* are associated with *P. malariae*, also in the order given. *P. falciparum* (*immaculatum*) is usually found in *A. minimus*, *A. tessellatus*, *A. maculatus* and *A. fuliginosus*, Giles.

ONO (S.). **The Life-history of** *Prosthogonimus putschkowskii* **found in the Vicinity of Mukden, South Manchuria.** [*?In Japanese.*]—*Nippon Zyûi Gakkwai Zasshi*, vii, no. 4, pp. 290–294, 2 pls. [? Tokyo] 1928. (Abstract in *Jap. J. Zool.*, ii, no. 3, p. (96). Tokyo, 1929.)

In South Manchuria the intermediate host of the fluke, *Prosthogonimus putschkowskii*, is the dragonfly, *Anax parthenope*, Selys [*cf. R.A.E.*, B, xv, 62, 209]. Male fowls can be experimentally parasitised, the fluke being found in the bursa fabricii. This parasite was not found in two species of *Sympetrum* or one of *Orthetrum*.

PAPERS NOTICED BY TITLE ONLY.

FALLERONI (D.). **Discussione sulla zooprofilassi e sugli altri mezzi di lotta contro la malaria. Nota quarta.** [A Discussion on Zooprophylaxis and other Measures against Malaria. Fourth Note.]—*Riv. Malariologia*, viii, no. 3, pp. 315–326. Rome, 1929. [*Cf. R.A.E.*, B, xv, 182; xvi, 150.]

MISSIROLI (A.) & HACKETT (L. W.). **La reazione precipitante per stabilire la provenienza del sangue succhiato dagli anofeli.** [A Description of the Precipitin Test for ascertaining the Origin of Blood sucked by Anophelines.]—*Boll. Ist. sieroter. milan.*, viii, pt. 5, pp. 273–282, 1 fig. Milan, May 1929. (With Summaries in Italian, French, German & English.)

KOIDZUMI (M.). **On the Distribution of** *Anopheles* **in Formosa.** [*In Japanese.*]—*Dobuts. Zasshi* [*Zool. Mag.*], xl, no. 476, pp. 219–228, 1928. (Abstract in *Jap. J. Zool.*, ii, no. 3, p. (105). Tokyo, 1929.) [*Cf. R.A.E.*, B, xvi, 151.]

WALCH (E. W.) & BONNE-WEPSTER (J.). **A simple and reliable Method for mounting** *Anopheles* **Larvae.**—*Meded. Dienst. Volksgezondh. Ned.-Ind.*, Foreign edn., xviii, no. 1, pp. 111–112. Batavia, 1929. [See *R.A.E.*, B, xvii, 177.]

OUDEMANS (A. C.). **Mededeelingen over** [Communications on] **Mallophaga en Pediculi VI.** [Larval Morphology of *Hoplopleura acanthopus*, Burm.]—*Tijdschr. Ent.*, lxxii, pp. 148–153, 1 fig. Amsterdam, 15th July 1929.

STEUDEL (—). **Die Schlafkrankheit in Deutsch-Ostafrika vom Beginn bis zur Gegenwort.** [Sleeping Sickness in Tanganyika Territory from the Beginning to the present Day.]—*Mitt. deuts. Schutzgeb.*, xxxvi, no. 2, pp. 61–79, 1 sketch map. Berlin, 1929.

Ono (S.). *Gymnopleurus sinuatus* **as the intermediate Host of Spiruridae found in the Vicinity of Mukden, South Manchuria.** [*In Japanese.*] —*Nippon Zyûi Gakkwai Zasshi*, viii, no. 1, pp. 51–58, 3 pls. [? Tokyo] March, 1929. (Abstract in *Jap. J. Zool.*, ii, no. 3, p. (96). Tokyo, 1929.)

Experiments with dogs in South Manchuria prove that the Coprid, *Gymnopleurus sinuatus*, Ol., is the intermediate host of *Spirura sanguinolenta*.

Pessôa (S. B.) & Corrêa (C.). **Nota sobre larvas de Nemathelminthos encontrados em Blattideos.**—*Sciencia med.*, vii, no. 6, pp. 304–305, 1 pl. Rio de Janeiro, June 1929.

Larvae of various roundworms, including a new species, are recorded from Blattids in Brazil. *Moniliformis moniliformis* was found in *Periplaneta americana*, L., and underwent complete evolution in rats in the laboratory.

Shelford (V. E.). **Laboratory and Field Ecology. The Responses of Animals as Indicators of correct Working Methods.**—Med. 8vo, xii + 608 pp., 219 figs. London, Baillière, Tindall & Cox, 1929. Price 45*s.* net.

The author describes the purpose of this important contribution to laboratory and field ecology as an endeavour to present the results of experience in researches aimed first at the discovery of the way and conditions of life of animals in nature and then at their transplantation into the laboratory for scientific control in experiments simulating natural conditions as closely as possible. He explains the selection, installation and operation of equipment for different kinds of climatic simulation to suit the organism under observation. In the course of research to determine the equipment necessary, a great deal of ecological data and results were collected, which are embodied in the present volume ; there is therefore much in it to interest not only the research worker, but also the student of this comparatively unexplored field. The first six chapters are confined largely to defining the viewpoint of animal ecology and to showing the setting of its problems, especially those that lend themselves to experimental work. Succeeding chapters deal with the relations of organisms to particular factors of the environment and with the methods of measuring and controlling each factor.

The most important hibernation and aestivation phenomena in general physiological and practical work are those exhibited by insect pests, and considerable space is devoted to a discussion of the theories regarding these phenomena.

The bibliography includes over a thousand titles.

Oudemans (A. C.). **Kritisch historisch overzicht der acarologie. Tweede gedeelte, 1759-1804.** [A critical, historical Survey of Acarology. Part Two, 1759–1804.]—*Tijdschr. Ent.*, lxxii, Suppl., xvii + 1097 pp., 266 figs., 51 pp. refs. Amsterdam, May 1929.

In the second part of this monumental work, the author brings his history of the study of mites and ticks up to the end of 1804. As in the first part [*R.A.E.*, B, xiv, 212], most of the volume is occupied

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by the systematic section, containing under each genus and species extracts from or notes on the works consulted. The systematic section is followed by detailed subject indices, for ecology, distribution, economic importance, medical zoology, etc.

Sarcoptes (*Acarus*) *caballi*, n. n., is proposed for *S. equi*, Gerlach, this name being preoccupied by *Psoroptes* (*S.*) *equi*, Hering.

NICOLLE (C.), ANDERSON (C.) & COLAS-BELCOUR (J.). **Sur les rapports du spirochète récurrent marocain** (*Sp. hispanicum* **var.** *marocanum*) **avec le porc-épic.**—*C. R. Acad. Sci. Fr.*, clxxxix, no. 5, pp. 224–226, 1 ref. Paris, 1929.

In investigations of the possibility of porcupines being naturally infected with the spirochaete of relapsing fever, the blood of a wild individual from Tunis was found to be free from infection. When, however, it was inoculated with blood from a guineapig heavily infected with *Spirochaeta hispanica* var. *marocana* from *Ornithodorus marocanus*, Velu, from Mansouria [*cf. R.A.E.*, B, xvi, 220 ; xvii, 168], spirochaetes were found in its blood in nine days, and two days afterwards the animal died. It is thought that this rodent may play a part in the preservation of the spirochaete [*cf.* xvii, 122], although it can only be of secondary importance, as it is rare and avoids houses.

DELANOË (P.). **Les spirochètes marocains des ornithodores des terriers et le spirochète de Mansouria ne sont pas doués de récurrence pour l'homme. Ils constituent une espèce distincte du spirochète espagnol,** *Sp. hispanicum* **S. de Buen, 1926.**—*C. R. Acad. Sci. Fr.*, clxxxix, no. 10, pp. 398–400, 2 refs. Paris, 1929.

Investigating the pathogenic power of spirochaetes from *Ornithodorus* [*marocanus*, Velu] from burrows of porcupines in Morocco and that of the spirochaete of Mansouria [*R.A.E.*, B, xvi, 220 ; xvii, 168] by inoculating them into man, the author found that they gave similar results, neither being recurrent in that host. From this it is concluded that these spirochaetes are identical, and distinct from *Spirochaeta hispanica* and the spirochaetes found at Rabat and Kenitra by Hornus and Chaubet [*R.A.E.*, B, xvii, 146], which are much more pathogenic to man. The author therefore considers that there are in Morocco at least three spirochaetes that infect man, *viz.*, *Spirochaeta recurrentis*, *S. hispanica* or a closely related form, and *S. marocana*, which must be considered a distinct species.

MOSKWIN (I. A.). **Ueber die Rolle der Zecke (Ixodoidea)** *Ornithodorus papillipes* **Bir. (Turkestan) in der Uebertragung des Rückfallfiebers.** [Notes on the Part played by the Tick, *O. papillipes*, Birula (Turkestan) in the Transmission of Relapsing Fever.]—*Z. Parasitenk*, ii, no. 1, pp. 73–89, 8 figs., 2 pp. refs. Berlin, 1929.

The epidemiology of relapsing fever in Uzbekistan is discussed, and *Ornithodorus papillipes*, Birula, the suspected vector, is described.

A detailed account is given of experiments already noticed [*R.A.E.*, B, xvi, 110] confirming the transmission of spirochaetosis to guineapigs and rabbits by means of *O. papillipes*. Since infection has been transmitted by ticks caught under natural conditions, it was concluded that *O. papillipes* is an undoubted vector of the disease, and this

conclusion was corroborated by the transmission of the infection by the bite of this tick to sufferers from progressive paralysis. Injection of emulsions of artificially infected ticks did not produce infection, but those of certain organs (salivary glands, digestive tract, malpighian tubes and ovaries) produced the infection in guineapigs. As positive results were secured in every inoculation with salivary glands, and as the incubation period was much shorter with these than with any of the other organs inoculated, it is concluded that the transmission of the spirochaetes takes place during the act of sucking.

PAVLOVSKY (E. N.) & CHODUKIN (N. J.). **Ueber die Anticoaguline und andere wirksame Bestandteile der Zecke** *Ornithodorus papillipes* **Bir.** On the Anticoagulin and other effective Substances contained in the Tick, *O. papillipes*.]—*Z. Parasitenk*, ii, no. 1, pp. 90–96, 10 refs. Berlin, 1929.

Experiments to determine the properties of the saliva and other body fluids of *Ornithodorus papillipes*, Birula, showed that anticoagulin is produced in the salivary glands of both sexes. As this tick does not give off any coxal fluid during the act of sucking, any anticoagulating effect on the blood of the host must be attributed to the saliva. Anticoagulin is also produced in the digestive tract. An emulsion prepared from the salivary glands exercises in certain concentrations a haemolysing effect on human blood. The fluid given off by the tick in the act of sucking blood possesses very great anticoagulating properties and rapidly agglutinates the erythrocytes in human blood.

FISCHER (C. R.). **De um novo Hymenoptero destruidor de motucas.** [A new Hymenopterous Destroyer of Tabanids.]—*Bol. biol.*, no. 15, pp. 43–46, 1 fig. S. Paulo, 30th June 1929.

The Sphegid, *Crabro tabanicida*, sp. n., is described from Brazil, where it preys on Tabanids. A list is given of eight species that have been found in its nests.

NIESCHULZ (O.). **Zur Entwicklung von** [On the Development of] *Tabanus rufiventris* **Fabr.** *Zbl. Bakt.*, (2) lxxviii, no. 16–23, pp. 428–433, 3 figs., 6 refs. Jena, 26th July 1929.

An account is given of a number of breeding-places of *Tabanus rufiventris*, F. (*crassus*, Wlk., *sanguineus*, Wlk.) in Java and Sumatra, where it prefers accumulations of water in sparsely or thickly wooded regions and avoids broad open spaces. Where larvae were found in open country, they had invariably been carried there in streams from neighbouring forests. They were equally numerous in soft humus soil, dry firm earth, stony ground and sand mixed with small pebbles. The larvae and pupae are described.

NIESCHULZ (O.) & KRANEVELD (F. C.). **Experimentelle Untersuchungen über die Uebertragung der Büffelseuche durch Insekten.** [Experimental Investigations on the Transmission of Buffalo Disease by Insects.]—*Zbl. Bakt.*, (1) Orig., cxiii, no. 5–6, pp. 403–417, 6 refs. Jena, 21st August 1929.

Experiments carried out in Java showed that haemorrhagic septicaemia of buffalos is readily transmitted from infected to

uninfected rabbits by Tabanids, Muscoid flies, and mosquitos. The longest interval between the infective feed and transmission was 6 days with *Tabanus rubidus*, Wied., 4 days with *T. striatus*, F., 3 days with *Chrysops dispar*, F., 24 hours with *Stomoxys calcitrans*, L., and *Musca inferior*, Stein, 6 hours with *Lyperosia exigua*, de Meij., and *Anopheles fuliginosus*, Giles, 24 hours with *Armigeres obturbans*, Wlk., and 2 days with *Aëdes argenteus*, Poir. (*Stegomyia fasciata*, F.). Transmission to several rabbits in succession was comparatively easy with *T. rubidus*, *S. calcitrans*, and *A. obturbans*. All the species examined had a remarkably high capacity for transmission, and it seems fairly certain that in suitable circumstances insects can be of importance in transmitting this disease.

Dieben (C. P. A.). **Enkele surraoverbrengingsproeven met** *Stomoxys calcitrans* **en** *Ctenocephalus canis*. [Some Experiments in the Transmission of Surra with *S. calcitrans* and *C. canis*.]—*Ned.-Ind. Bl. Diergeneesk.*, xl, no. 1, pp. 57–83, 54 refs. Batavia, 1928.

The experiments reported on here were made in Holland in 1923. *Trypanosoma evansi* was transmitted mechanically to guineapigs by *Stomoxys calcitrans*, L., in the case of interrupted feeds. The trypanosome survived for at least 30 hours in the stomach of the fly, but did not develop or increase in it. *T. evansi* was not transmitted mechanically by *Ctenocephalus canis*, Curtis, and in most cases it failed to develop in the digestive tract of the flea. In a few instances, however, small trypanosomes were found in the hind gut.

Missiroli (A.). **I protozoi parassiti del** *Phlebotomus papatasii*. [The Protozoa parasitic in *P. papatasii*.]—*Ann. Igiene*, xxxix, no. 7, pp. 481–487, 1 pl. Rome, July 1929.

Records of the distribution in Italy of *Phlebotomus papatasii*, Scop., are reviewed, and an account is given of the first part of an investigation on its importance in that country as a vector of *Leishmania infantum* and *L. tropica*. No parasites were found in sandflies taken in localities where human leishmaniasis occurs, and in others the only ones found were a form resembling a developmental stage of *Trypanosoma lewisi* and *Monocystis mackiei*.

McAtee (W. L.). **Further Notes on Insect Inhabitants of Bird Houses.**—*Proc. Ent. Soc. Wash.*, xxxi, no. 6, pp. 105–111. Washington, D.C., June 1929.

Supplementary to the previous report [*R.A.E.*, A, xv, 131], further records are given of insects found inhabiting bird houses in Maryland. Even rather heavy infestations of the parasitic fly, *Phormia* (*Protocalliphora*) *splendida*, Macq., were not found especially destructive to nestling birds [*cf.* xvii, 133].

Maxcy (K. F.). **Typhus Fever in the United States.**—*Pub. Hlth. Rep.*, xliv, no. 29, pp. 1735–1742. Washington, D.C., 19th July 1929.

An account is given of endemic typhus (Brill's disease) in the southern United States [*R.A.E.*, B, xv, 51 ; xvii, 69]. Experiments show that

the disease produces symptoms in experimental animals exactly similar to those of Mexican typhus (tabardillo), which is considered identical with it, the reaction being similar to that of strains from the Old World, but showing constant, though slight, differences in guineapigs. Notwithstanding the differences, the three strains immunise against each other. Moreover, micro-organisms that seemed to correspond to *Rickettsia prowazeki* were found in infected guineapigs. Although the the Weil-Felix reaction is positive, the value of this observation has been modified by the recent discovery that this reaction is also positive in Rocky Mountain spotted fever, a disease which, although it belongs to the typhus group, is immunologically distinct.

CHEVALIER (L.). **Note sur deux mangeurs de punaises des lits.**—*Bull. Soc. Sci. Seine-et-Oise*, (2) x, no. 3, pp. 46–48. Versailles, 1929.

The larva of *Reduvius personatus*, L., and the pseudoscorpion, *Chelifer cancroides*, L., are recorded as attacking bed bugs [*Cimex lectularius*, L.].

CARPANO (M.). **Sulla piroplasmosi dei volatili domestici determinata dalla** "*Aegiptianella pullorum.*" [Piroplasmosis of Poultry due to *Aegyptianella pullorum.*]—*Clinica vet.*, lii, nos. 6 & 8, pp. 339–348, 2 pls., 475–476. Milan, 1929.—*Ann. Paras. hum. comp.*, vii, no. 5, pp. 365–366. Paris, September 1929.

Aegyptianella pullorum [*R.A.E.*, B, xvii, 204] is also recorded from geese in Egypt, in which it sometimes occurs together with *Spirochaeta anserina*, which is considered identical with *S. gallinarum*. *Argas persicus*, Oken, is believed to be the vector of both organisms.

VON LENGERKEN (H.). **Vermilbter Mais als Todesursache bei Pferden.** [Mite-infested Maize as a Cause of Death in Horses.]—*Anz. Schädlingsk.*, v, no. 8, pp. 98–99. Berlin, 1929.

Cases of sickness and death in horses caused by feeding on mite-infested maize are cited from the literature. The symptoms included inflammation of the respiratory and digestive organs and lameness, and appear to have been due to direct irritation by the living mites. Whereas cases of this kind were particularly numerous at the end of the War, when the quality of the maize was poor, infestation by mites still constitutes a serious danger. Healthy horses on estates near Berlin developed symptoms of fever after feeding on infested maize in 1928, and recovered as soon as the food was changed. The symptoms returned when feeding on the infested maize was resumed. Examination of the maize showed a moderate infestation by mites, the species most largely represented being *Tyroglyphus* (*Aleurobius*) *farinae*, DeG., though *Glyciphagus domesticus*, DeG., and *Chevletus eruditus*, Schr., also occurred. Other cereals and animal food of various kinds stored with the maize were not infested.

COLLADO (J. G.). **Los insectos hematófagos y transmisores de enfermedades.** [Blood-sucking and Disease-transmitting Insects.]—48 pp., 21 figs. Madrid, Dirección General de Sanidad, 1927.

A general account is given of blood-sucking insects and their relation to disease, including also a brief note on Oestrids that usually attack

domestic animals, but sometimes cause myiasis in man. An appendix gives the local distribution in Spain of mosquitos and *Phlebotomus*, and also records the rat fleas found in Barcelona, 96 per cent. of which were *Xenopsylla cheopis*, Roths., the others being *Ceratophyllus fasciatus*, Bosc, and *Ctenocephalus felis*, Bch.

PATTON (W. S.) & EVANS (A. M.). **Insects, Ticks, Mites and Venomous Animals of Medical and Veterinary Importance. Part I.—Medical.** —x+786 pp., 60 pls., 374 figs., 1 diag. The Authors, Liverpool School of Tropical Medicine, 1929. Price, 20*s*.

This volume is the first of a series of four under this title, which covers the course for the diploma given at the Liverpool School of Tropical Medicine. The authors present in a concise form not only the essentials of the subject, but a great deal of more detailed information that is not available elsewhere. The course consists of twenty-eight lectures; the first is an introductory one; the next five deal with the external and internal anatomy of an Arthropod as exemplified mainly by the Diptera, and the remaining twenty-two are devoted to the more detailed part of the course and include two class examinations. A special feature of the book is the numerous excellent illustrations, most of which are original drawings of specimens exhibited.

NIESCHULZ (O.) & KRANEVELD (F.). **Over de prophylactische waarde van Naganol bij paarden-surra.** [On the prophylactic Value of Naganol in Surra of Horses.]—*Ned.-Ind. Bl. Diergeneesk.*, xl, no. 6, pp. 491–509. Batavia, 1928. (With a Summary in German.)

In these experiments, which indicate that this drug is of doubtful value, *Tabanus rubidus*, Wied., was chosen for the transmission of surra from horse to horse, because direct transmission by it gives an infection rate of about 50 per cent.

NIESCHULZ (O.). **Enkele miltvuuroverbrengingsproeven met Tabaniden, Musciden en Muskieten.** [Some Experiments in Anthrax Transmission with Tabanids, Muscids and Mosquitos.]—*Veeartsenijk. Meded.*, no. 67, pp. 1–23. Buitenzorg, 1928.

A brief account is given of the literature on the transmission of anthrax by insects. The author's experiments were made with guineapigs in Java. Direct transmission with *Tabanus rubidus*, Wied., succeeded in all cases, and a varying degree of success resulted with a gradual increase of the interval between feeds. With an interval of 3 days, two experiments out of six gave positive results. Similar results were obtained with *T. striatus*, F. Direct transmission was successful with *Chrysops flaviventris*, Macq., and in one out of five experiments transmission took place after half an hour. Direct transmission succeeded with *Stomoxys calcitrans*, L., as did transmission after an hour in one out of eight experiments. Direct transmission succeeded in one of six experiments with *Musca inferior*, Stein, and in one of fifteen with *Aëdes argenteus*, Poir. (*Stegomyia fasciata*, F.), but failed with *Lyperosia exigua*, de Meij., *Anopheles fuliginosus*, Giles, and *Armigeres obturbans*, Wlk. The transmission capacity of Tabanids and Muscids is higher

than for surra. It would seem that Tabanids in particular are likely to be of importance in the natural transmission of anthrax in view of their great abundance and their capacity for remaining infective for several days.

NIESCHULZ (O.) & HUBER (F. L.). **Over enkele boutvuur- en paraboutvuuroverbrengingsproeven met Tabaniden.** [On Experiments in the Transmission with Tabanids of "Blackwater" and Allied Conditions.]—*Veeartsenijk. Meded.*, no. 67, pp. 24–27. Buitenzorg, 1928. (With a Summary in German.)

In a series of experiments, one individual of *Tabanus rubidus*, Wied., transmitted "blackwater" from a calf to a guineapig. All experiments with *T. striatus*, F., failed, as did all those with *T. rubidus* and "parablackwater."

NIESCHULZ (O.). **Zoologische Beiträge zum Surra-problem. xx. Verdere surraoverbrengingsproeven met enkele Tabaniden-soorten op Sumatra.** [Further Transmission Experiments with Tabanids in Sumatra.—*Veeartsenijk. Meded.*, no. 66, 59 pp., 3 pls., 6 refs. Buitenzorg, 1928. (With a Summary in German.) **xxvi** [? xxvii]. **Over den incubatietijd bij surrainfecties.** [On the Incubation Period in Surra Infections.]—*Ned.-Ind. Bl. Diergeneesk.*, xli, no. 3, pp. 253–264. Batavia, 1929. (With a Summary in German.)

The experiments in surra transmission described in the first paper were made in 1927 in Sumatra. All Tabanids can probably transmit surra; of the 18 species used, only five failed to do so, and of these only a few individuals were available. All the flies were taken in the field on healthy buffalos. Positive results were obtained with *Tabanus immanis*, Wied., *T. fumifer*, Wlk., *T. ceylonicus*, Schin., *T. minimus*, Wulp (all these four being recorded carriers), *T. malayensis*, Ric., *T. albitriangularis*, Sch. Stekh., *T. optatus*, Wlk., *T. rufiventris*, F., *T. latifacies*, Sch. Stekh., *T. griseipalpis*, Sch. Stekh., *T. bilateralis*, Sch. Stekh., *T. vanecki*, sp. n., and *Chrysops fasciata*, Wied. *T. immanis* and *T. minimus* transmitted infection to several animals in succession. *T. immanis*, the only species tested in this connection, was infective six hours after the infecting feed.

The second paper records observations on the incubation period of surra, this being of interest in connection with quarantine measures and in ascertaining the origin of an infection, etc. The periods in days for the various animals were: horses, 7–13; monkeys, 8; dogs, 8–28; guineapigs, 7–41; rabbits, 5–14; rats, 5–18; mice, 6–8.

PARKER (R. R.) & DADE (J. [S.]). **Tularemia: its Transmission to Sheep by the Wood Tick,** *Dermacentor andersoni* **Stiles.**—*J. Amer. Vet. Med. Ass.*, lxxv (N.S. xxviii), no. 2, pp. 173–191, 9 refs. Detroit, Mich., August 1929.

This is a fuller account of experiments carried out in Idaho in 1928, showing that a disease of sheep that has been responsible for serious losses in the southern part of the State for some years is caused by *Bacterium tularense* and is transmitted by *Dermacentor venustus*, Banks (*andersoni*, Stiles) [*R.A.E.*, B, xvii, 130]. The symptoms and patho-

logy of the disease in sheep are described, a brief account is given of its previous occurrence in Idaho, and the observations and results of experiments are discussed in some detail. Associated with the outbreaks of the disease in sheep, there was high mortality among jack rabbits ; the dead rabbits were reported to be heavily infested with ticks, and it is known that individuals of *D. venustus* and *Haemaphysalis leporis-palustris*, Pack. (rabbit tick) that have hibernated can transmit tularaemia to rabbits.

The part played by *D. venustus* in causing the disease in sheep is indicated by the following facts : it occurs only during the season when the ticks are active, and it appears in early spring soon after the sheep are placed on tick-infested sage-brush ranges ; in an affected flock, a high percentage of infection was present in ticks taken from infected sheep, and the evidence points to *D. venustus* as the only likely transmitting agent ; when affected flocks are moved from tick-infested areas, there is an abrupt drop in the incidence of new cases ; affected sheep usually recover if they are freed from ticks, whereas recovery is far less frequent if the ticks are allowed to remain.

Several points in the epidemiology of the disease cannot yet be explained satisfactorily. Sheep of all ages are not equally affected, the cases being limited to lambs in some instances and to yearlings in others. Fatal infections have been produced in sheep by inoculation, but some sheep, at least, appear to be more or less resistant. All the outbreaks so far observed have occurred early in the tick season. This is possibly because the virulence of *B. tularense* in the tick decreases as the season advances, and is not sufficiently great to overcome the natural resistance of the sheep except in the early spring ; laboratory observations have shown that tularaemia infection is far less persistent in *D. venustus* than is the virus of Rocky Mountain spotted fever. It is possible that the natural resistance of normal sheep is only broken down by the continued injection of infecting organisms that results from prolonged feeding by infected ticks, and that if the ticks are removed before resistance has been completely overcome, recovery takes place. There is no evidence of the occurrence of tick paralysis in Idaho, and it has not been determined whether, as in cases of tick paralysis, the removal of the female ticks only will bring about recovery. In Montana, this was so, but there was uncertainty whether the condition there was caused by tick paralysis or tularaemia [xvii, 130].

THEOBALD (F. V.). **Insects, etc., injurious to Stock** [in 1928].—*J. S.-E. Agric. Coll.*, no. 26, pp. 113–114. Wye, Kent, 1929.

Arthropods injurious to stock, etc., in England in 1928 included the ox warble-flies, *Hypoderma bovis*, DeG., and *H. lineatum*, Vill. ; *Dermanyssus gallinae*, DeG. (*avium*, Dug.), infesting fowls and canaries ; and *Esthiopterum crassicorne*, Scop. (*Lipeurus squalidus*, Nitz.), on ducks.

CURSON (H. H.). **Metazoan Parasites from Zululand.**—*S. Afr. J. Nat. Hist.*, vi, no. 3, pp. 181–187. Pretoria, April 1928.

This list includes various parasitic Arthropods observed in Zululand, with their hosts, as well as a number of blood-sucking Diptera. The ticks, *Ornithodorus moubata*, Murr., *Rhipicephalus masseyi*, Nutt. & Warb., *Amblyomma nuttalli*, Dön., and *Haemaphysalis parmata*, Neum.,

have not been previously recorded from Zululand. In view of the restricted occurrence of *Ixodes* in South Africa, the locality record of *I. ugandanus*, Neum., is particularly interesting since it does not appear to have been described before from that country. *Xenopsylla cheopis*, Roths., was taken on a native rat.

MURRAY (W. A.). **Plague Problems in South Africa.**—*S. Afr. J. Nat. Hist.*, vi, no. 4, pp. 308–314. Pretoria, June 1929.

In this paper, an outline is given of some of the problems that must be solved before the prevention and suppression of plague among small mammals and in man in South Africa can be dealt with on scientific lines. A study of the distribution of the rodents that are concerned in the spread of rodent plague shows that practically half the Union of South Africa is involved, and the extent of the area where rodent plague exists or has recently existed makes the question of eradication, prevention or even limitation extraordinarily difficult. The practical impossibility of obtaining the full co-operation of property owners in the effective limitation or eradication of the veldt rodents on their land or the domestic rodents on their premises in urban areas is pointed out. The many species of veldt rodents, the varieties of fleas they carry, and their interrelations with one another and with man are discussed [*R.A.E.*, B, xv, 169–173]. Little is known of the hibernation of fleas in the nests of rodents below ground or of their relation to their hosts. The fleas infesting rodents seem to vary considerably with the season of the year, as well as with the district in which they are found; for example, *Dinopsyllus lypusus*, J. & R., is found all the year round on its hosts, whereas *Xenopsylla eridos*, Roths., is principally found during the rainy season and *Chiastopsylla rossi*, Waterst., is abundant during the dry season. Other questions that arise are concerned with the factors that start a new outbreak of rodent infection in areas where plague has been absent or dormant for several years, and the influence of temperature and humidity on the persistence of plague in burrows [*cf.* xv, 172].

HORNBY (H. E.) & BAILEY (H. W.). **Research on Trypanosomiases.**—*Ann. Rep. Dep. Vet. Sci. Anim. Husb. Tanganyika Terr., 1928*, pp. 19–28. Dar es Salaam [1929].

In surveying the subject of trypanosomiasis of animals in Africa, the authors convey a warning against considering this disease to be so closely associated with *Glossina* that it disappears with the eradication of the latter, and ignoring the existence of many areas where it remains enzootic in the absence of tsetse. Local control of tsetse-flies is, however, the greatest single step that can be taken towards suppressing trypanosomiasis in districts where the fly occurs. Tabanids are now known to be capable of spreading infections of *Trypanosoma vivax* and *T. congolense*, and although the majority of investigators have been unable to produce infection through *Stomoxys*, yet 80 per cent. of adult buffalos in an area in Tanganyika Territory where *Stomoxys* was abundant became infected with *T. congolense* in the apparent absence of all other biting flies. Mechanically transmitted trypanosomes are rarer in calves than in adults because attractiveness to flies has a

mathematical relation to size of the animal. Among the cattle on the Laboratory farms, there have been serious losses from trypanosomiasis, mostly due to *T. congolense*, the vectors being apparently *Stomoxys* and *Haematopota*. So numerous were *Haematopota* spp. after the first heavy rains, that one weak animal was tormented to death.

Although large herds or flocks of animals are never found in dense fly belts, healthy flocks of sheep and goats are commonly seen in light fly areas; there are also occasional small herds of cattle in dense fly belts and larger herds in light fly country. The explanation probably is that goats and sheep are not bitten by *Glossina* to the same extent as cattle, and they are somewhat less susceptible to *T. congolense* and *T. vivax*, though not to *T. brucei*. There is also the factor of individual susceptibility and resistance; in the case of herds in dense fly belts, natural selection has operated to produce animals highly resistant to local strains of trypanosomes. In the authors' opinion, however, the occurrence of domestic mammals resistant to fatal infection by all strains of trypanosomes is much rarer.

FREW (J. G. H.). **Report on the Tsetse Fly Survey of Sierra Leone. September 1927-February 1929.**—8vo, 16 pp. Freetown, Sierra Leone, 1929.

In the course of this survey, the species of tsetse-fly found in Sierra Leone included *Glossina palpalis*, R.-D., *G. fusca*, Wlk., and *G. longipalpis*, Wied. One individual of *G. pallicera*, Big., was found, and *G. nigrofusca*, Newst., has been recorded once by another observer [*R.A.E.*, B, ii, 27]. Only *G. fusca* was ever taken at night. *G. palpalis* occurs throughout the Protectorate, but its density is small in most localities, and it is confined to the vicinity of water. It does not attack man readily, and it is less numerous in settled and thickly populated areas than in similar areas further in the bush. The author has noticed that it always seems very scarce where oil palms are plentiful. Bush pigs are considered by the natives to be its chief source of food, though in the mangrove creeks crocodiles are probably preferred. *G. fusca* is less dependent on water and is restricted to areas of heavy shade, at least during the day. It attacks man far more readily than *G. palpalis* and is generally considered to be associated with elephants, buffalos and cattle. *G. longipalpis* is largely restricted to a rather dense type of savannah forest with some underbush where wild game is plentiful. According to the natives, much injury is done to cattle by the small Muscid, *Musca* (*Biomyia*) *tempestata*, Bezzi, which causes sores by feeding at the punctures caused by tsetse and other biting flies.

G. fusca is a practically negligible factor where cattle are concerned; it does not occur in country that is at all suitable for cattle rearing on a large scale. The only effective measure for its elimination would be the destruction of the high bush and forest that harbour it, and this is both impracticable and undesirable. If a great cattle industry is built up in Sierra Leone, it will be in the north, and it may then prove advisable to clear certain cattle routes of high bush for about 40 yards on each side; this would, however, be a great expense and might be obviated by choosing routes that do not traverse country harbouring *G. fusca*. *G. palpalis*, on the other hand, will always remain a danger to cattle unless the river banks are cleared. It would be quite possible and economical to clear small stretches for drinking places, but the

cattle would have to be induced to drink only at such spots ; a salt lick might serve to attract them. *G. longipalpis* presents a problem in only one district that is suitable for cattle rearing—the northern Karene district. Bush burning is not recommended there owing to the type of vegetation. The natives consider an increase in wild game to be the cause of increasing numbers of this species ; as the population, which is at present very sparse, increases, game will tend to disappear.

SIMMONDS (H. W.). **Introduction of Natural Enemies against the House Fly in Fiji.**—*Agric. J. Fiji*, ii, no. 2, p. 46. Suva, 1929.

In addition to *Spalangia cameroni*, Perk. [*R.A.E.*, B, xvii, 209], the dung-burying beetle, *Copris incertus* var. *prociduus*, Say, has also been imported into Fiji from Hawaii for the control of the house-fly [*Musca* sp.]. Some 615 beetles have been liberated near Suva, and it is hoped that by breaking up the cow droppings they will reduce the amount of material suitable for the fly maggots.

SIMMONDS (H. W.). **Experiments with House Flies in Fiji.**—*Agric. J. Fiji*, ii, no. 2, pp. 46–47. Suva, 1929.

During the wet or summer season in Fiji, house-flies [*Musca* sp.] become exceedingly numerous owing to their breeding in great numbers in cow dung. With the cool season, which is often also much drier, the numbers become almost negligible. Observations show that oviposition in the droppings continues, but that the maggots in most cases fail to mature, dying generally shortly after hatching. The cause of this mortality is not known. Experiments described in this paper indicate that the lower temperatures of the winter season are not the direct factor, as development was completed at temperatures lower than those occurring in nature, though the life-cycle was considerably prolonged. Marked droppings remained sufficiently moist for development when 14 days old, so that even in the case of prolonged development no explanation is afforded for the reduction in the numbers of the fly.

NASONOV (N. V.). **Notes sur les phlébotomes. III.**- *C.R. Acad. Sci. U.R.S.S.*, 1929, no. 16, pp. 391–393, 5 refs. Leningrad, 1929.

In further investigations on the distribution of *Phlebotomus* in the Crimea [*R.A.E.*, B, xiv, 189 ; xv, 54 ; xvi, 110], *P. papatasii*, Scop., was the only sandfly found in Sevastopol. Conditions on the south coast of the Peninsula are probably unfavourable to it, as it was never found there, although it could easily be imported in ships from Sevastopol. The species abundant along this coast was *P. perniciosus* var. *tauricus*, Nasonov, and as sandfly fever has never been recorded there, the author concludes that this species is not a vector.

The marked increase during the last 30 years in the numbers of sandflies on the south coast of the Crimea is explained by the gradual drying up of the region as a result of the felling of trees on the Yaila mountains and forest fires. In Sevastopol the abundance of ruins and heaps of stones, and archaeological excavations in the neighbourhood, offer particularly favourable conditions for the breeding of *Phlebotomus*.

[Khodukin (N. I.).] **Ходукин (Н. И.). On the Question of Hibernation by the Larvae of some Turkestan Species of** *Phlebotomus*. [*In Russian.*]—*Meditz. Muisl' Uzbekistana*, ii, no. 1, pp. 78–82, 3 refs. Tashkent, October 1927. (With a Summary in German, p. 128.) (Abstract in *Trop. Dis. Bull.*, xxv, no. 10, p. 821. London, October 1928.)

According to the German summary, the author, in studies of the hibernation of *Phlebotomus li*, Popov, *P. sergenti*, Parr., and *P. papatasii*, Scop., in Turkestan, independently observed the phenomenon termed "heterodynamy" by Roubaud. In general, his observations agree with those of the latter [*R.A.E.*, B, xvi, 56]. He found that the "asthenic" stage of the larvae of these species might, without any exposure to cold, be much protracted (to 355 days); and that the larvae could withstand exposure to temperatures between — 7 and — 10° C. [19·4 and 14° F.] for only a short time. The usual term of larval "asthenobiosis" (started by a critical lowering of temperature to 11 and 12° C. [51·8 and 53·6° F.]) ranged between 2 weeks and 2 months. In the same generation may occur both "asthenic" larvae (*i.e.*, larvae whose growth is definitely protracted) and "active" larvae (*i.e.*, larvae that become full-grown in the course of about 3 weeks). The longevity of the hibernating ("asthenic" or torpid) larva depends upon the timely onset of the critical low temperature; if this falls too late, only a few of the larvae recover.

Blanc (G.) & Caminopetros (J.). **Quelques données expérimentales sur le virus de la dengue.**—*C.R. Acad. Sci. Fr.*, clxxxix, no. 16, pp. 594–596, 5 refs. Paris, 1929.

Serum taken from a convalescent from yellow fever has no effect on the virus of dengue, either *in vivo* or *in vitro*. The virus in *Aëdes* (*Stegomyia*) [*argenteus*, Poir.] is easily filtrable. It remains in the blood of persons suffering from the disease at least until the fifth day, and can then infect the mosquito. These facts clearly differentiate the virus of dengue from that of yellow fever.

Prado (A.). **Zootropismo dos** *Anopheles*.—*Sciencia med.*, vii, no. 8, pp. 379–381, 1 fig. Rio de Janeiro, August 1929.

In a farm colony in a district of S. Paulo, Brazil, with an average malarial endemicity, no cases of malaria were observed on the farm in autumn (April) in spite of heavy summer rains and a great abundance of Anophelines. Three months previously (January), immigrants from the North had come to the colony, its inhabitants numbering 200 in April. No mosquitos could be found in human dwellings, but they were taken abundantly by night on the numerous cattle both in the open and in sheds. Even in full sunlight, animals were attacked by Anophelines, *Anopheles brasiliensis*, Chagas, being among the species bred and captured. The maxillary teeth in various individuals of *A. brasiliensis* captured on animals numbered 14 as compared with 10 in examples of *A. cruzi*, D. & K., from the coastal malarial region of Serra do Mar where cattle are absent. It is considered that the presence of cattle at these farms is a valid protection, the Anophelines there having become adapted to these animals.

DE BEAUREPAIRE ARAGÃO (H.) & DA COSTA LIMA (A.). **On the Infection of *M. rhesus* by Contact of the uninjured Skin and Conjunctiva with the Excreta of infected Mosquitoes. About the Time required by the infected *Stegomyia* to expel virulent Excreta.**—*Suppl. Mem. Inst. Oswaldo Cruz*, no. 9, pp. 133–138, 139–145. Rio de Janeiro, 31st July 1929. (In Portuguese and English.)

The first paper gives details of experiments referred to in a previous paper [*R.A.E.*, B, xvii, 213].

The infectious nature of the excreta of mosquitos [*Aëdes argenteus*, Poir.] that are in a condition to transmit yellow fever by their bites having been established, an investigation was made to ascertain whether the excreta were infective before the ninth day after the mosquito had become infected, this period being considered the minimum in which the bites become infective. The experiments described here prove that the yellow fever virus may be present in the excreta 5 days after the mosquito has fed on an infected monkey (*Macacus rhesus*). The minimum time was not ascertained.

DE BEAUREPAIRE ARAGÃO (H.). **On Infection of the Male *Aëdes aegypti* [*A. argenteus*, Poir.] and the Possibility of Propagation of Yellow Fever from *Stegomyia* to *Stegomyia* without Passage through Man.**—*Suppl. Mem. Inst. Oswaldo Cruz*, no. 9, pp. 190–195. Rio de Janeiro, 31st July 1929. (In Portuguese and English.)

In these experiments, males of *Aëdes argenteus*, Poir. (*aegypti*, auct.) were infected with yellow fever by feeding on defibrinated blood of infected *Macacus rhesus*, 5 per cent. of honey being added to render the blood attractive to them. Other males were infected by being kept with infected females, and females by being kept with infected males.

CHAGAS (C.). **La fièvre jaune.**—*Bull. Soc. Path. exot.*, xxii, no. 6, pp. 398–407. Paris, 1929.

In this lecture, the author gives a brief account of the recent outbreak of yellow fever in Rio de Janeiro, and the measures taken to combat it [*R.A.E.*, B, xvii, 69], together with a summary of the more important experimental work on the disease carried out at the Oswaldo Cruz Institute [xvii, 34, 213]. Protective inoculation, which has been employed on a considerable scale, has not proved entirely satisfactory. It has been found that there is a progressive diminution of the alexine in the serum of yellow fever patients from the first day of the disease; this is of great importance in the early diagnosis of the disease and consequently in prophylaxis [*cf.* next paper].

CAZANOVE (F.). **Le diagnostic prophylactique et les symptômes de début de la fièvre jaune.**—*Bull. Soc. Path. exot.*, xxii, no. 6, pp. 447–473. Paris, 1929.

The author describes, with details of cases, the early symptoms of yellow fever, as observed in Senegal, laying particular stress on the diagnostic importance of albuminuria, especially in mild cases. Since it is only during the first three days of the disease that the patient is

infective for *Aëdes argenteus*, Poir. (*Stegomyia fasciata*, F.), early diagnosis is of great value, especially at the beginning of an outbreak. The sooner the first cases are isolated, the less chance is there for mosquitos to become infected ; moreover, mosquitos do not fly far immediately after engorging, but remain for a time in the room or house in which they have fed, so that a rapid diagnosis gives a better chance of destroying infected individuals.

LEGENDRE (J.). **Au sujet de la pathogénie de la dengue.**—*Bull. Soc. Path. exot.*, xxii, no. 6, pp. 419–423, 1 ref. Paris, 1929.

The author criticises the theory put forward by Cardamitis [*R.A.E.*, B, xvii, 166] that dengue and sandfly (three-day) fever are two forms of the same disease, the former produced as a result of transmission by *Aëdes argenteus*, Poir. (*Stegomyia fasciata*, F.) and the latter by *Phlebotomus papatasii*, Scop. He points out that mild cases of dengue, lasting three days or less, either with or without a rash, are not uncommon in the absence of *Phlebotomus*, whereas in areas in which *A. argenteus* does not occur, sandfly fever, although normally of shorter duration, may be more severe than dengue.

In the discussion that followed, F. Cazanove mentioned an outbreak of sandfly fever recorded by Couvy [*R.A.E.*, B, xi, 42], in a locality in Syria, where, on account of the altitude, mosquitos were absent ; in this outbreak, the symptoms were typical of sandfly fever in some patients, whereas in others they closely resembled those of dengue. On the other hand, in 1926 at Dakar, in an outbreak of dengue attributed to *A. argenteus*, cases typical of sandfly fever occurred. Moreover, in 1927, cases of yellow fever occurred at Dakar in which the symptoms were typical of either dengue or sandfly fever. Although in typical cases, these three diseases are perfectly distinct, many instances occur in which they are very similar. Finality will not be reached in the case of dengue and sandfly fever until a bacteriological or serological test by which they can be distinguished is discovered.

FOLEY (H.) & PARROT (L.). **Sur l'existence d'***Ornithodorus marocanus* **Velu en Algérie (Sud-Oranais).**—*Bull. Soc. Path. exot.*, xxii, no. 6, p. 436. Paris, 1929.

The discovery of nymphs of *Ornithodorus marocanus*, Velu, in the burrow of a small rodent near Beni Ounif on the northern edge of the Sahara, near the western frontier of Algeria, is recorded.

SERGENT (Et.) & PARROT (L.). **Sur la répartition géographique de** *Ornithodorus marocanus* **Velu, en Algérie.**—*Bull. Soc. Path. exot.*, xxii, no. 6, pp. 436–437, 2 refs. Paris, 1929.

The authors found a number of engorged nymphs and adults of *Ornithodorus marocanus* in the deserted burrow of a small rodent about 11 miles north of Biskra, in the south of the department of Constantine, eastern Algeria. In the same burrow were two toads (*Bufo viridis*), and an examination of the blood in the intestine of the ticks showed that they had engorged on these Batrachians.

Villeneuve de Janti (J.). **Sur une forme inédite des Calliphorinae testaceae de Robineau-Desvoidy (Bengaliini de Tyler-Townsend).**—*Bull. Soc. Path. exot.*, xxii, no. 6, pp. 437–439. Paris, 1929.

Both sexes of *Cordylobia roubaudi*, sp. n., from Senegal and Tanganyika, are described and compared with *C. anthropophaga*, Grünb.; the systematic position of the new species is discussed, and a new subgenus, *Neocordylobia*, is erected to receive it. Nothing is known of its bionomics.

Blanc (G.) & Caminopetros (J.). **Quelques mots sur le mode de conservation des stégomyias en cage.**—*Bull. Soc. Path. exot.*, xxii, no. 6, pp. 440–444, 2 figs., 1 ref. Paris, 1929.

This is an account of the methods used for keeping adults of *Aëdes* (*Stegomyia*) [*argenteus*, Poir.] alive through the winter in Greece, in order to determine the duration of dengue infection in them [*R.A.E.*, B, xvii, 169]. The mosquitos were put in cages 16 ins. long by 11 ins. wide and 10 ins. high, with the top and two sides consisting of wire gauze, and with a small door and a sleeve of two thicknesses of muslin at one end. In each cage were placed two pots of porous earthenware, of the type used in Greece as money-boxes, having a narrow slit as the only aperture. These were filled with water, and the slits closed with cotton wool. The mosquitos settled and oviposited on the pots, particularly at the base, where the water soaked through most freely. The cages were placed in a dark room, 4 ft. wide by 6 ft. long, opening into another dark room, 8 ft. by 6 ft., in which was a gas stove; in the rooms were large receptacles filled with water. The cages stood on openwork tables, with pots of water underneath, and were covered with thick woollen cloths. The temperature was maintained at 15–20° C. [59–68° F.] throughout the winter, and when in March it was allowed to rise to 25·5° C. [78° F.], heavy mortality occurred, in spite of the humidity. It therefore appears that with artificial heat, *A. argenteus* should be kept at a temperature below 20° C.

Raisins were placed in the cages and were renewed as soon as they began to get mouldy. So long as the outdoor temperature was fairly mild, the cages were taken every few days to a hospital, where the mosquitos were allowed to engorge on patients susceptible to dengue. When the temperature was too low for the mosquitos to be transported to the hospital without special precautions, they were allowed to feed every three or four days in the laboratory on the arm of a person who had recovered from dengue.

On 10th May, some mosquitos captured in a house on 9th October were still alive after 215 days, and other mosquitos had survived 164, 197 and 199 days.

Laigret (J.). **Onchocercose humaine et éléphantiasis au Soudan français.**—*Bull. Soc. Path. exot.*, xxii, no. 6, pp. 499–506, 4 pls., 8 refs. Paris, 1929.

A condition described as elephantiasis is fairly common in the French Sudan, although *Filaria bancrofti* apparently does not occur there. The author's investigations showed that onchocerciasis, caused by *Onchocerca volvulus*, which had not previously been reported from the

French Sudan, is as common there as in French Equatorial Africa. That this Nematode, transmitted by *Simulium*, should extend so far to the north, almost to the desert regions, is surprising ; apparently the occasional watercourses, which contain water only for a few weeks in each year, are sufficient to produce an abundance of Simuliids. There seems to be a close relation between onchocerciasis and elephantiasis in this region ; *O. volvulus* was always found in persons in the early stages of elephantiasis.

Smorodinzev (I. A.) & Adova (A. N.). **Variations de la conductibilité électrique des eaux de réservoirs artificiels dans l'étude de l'écologie des larves d'Anophèles.**—*C. R. Soc. Biol.*, c, pp. 88–89, 1 ref.

Adova (A. N.) & Smirnova (A. M.). **Sur les variations du degré d'oxydation dans les réservoirs d'eau artificielle dans l'étude de l'écologie des Anophèles.**—*T. c.*, pp. 998–1000, 2 refs.

Smorodinzev (I. A.) & Bagenova (A. P.). **Les variations de la teneur en oxygène de réservoirs d'eau artificielle. Recherches sur la biologie des Anophèles.**—*Op. cit.*, ci, pp. 991–993, 5 refs. Paris, 1929.

Further observations made in eight artificial reservoirs [*R.A.E.*, B, xvii, 65] showed that the principal chemical factors in marshy waters only undergo slight modifications, so that it is possible to utilise them in research on the behaviour of Anopheline larvae in such waters.

Cousin (G.). **Influence de l'alimentation, des gaz toxiques et de la température sur la diapause de** *Lucilia sericata* **Meig.**—*C. R. Soc. Biol.*, ci, no. 25, pp. 1115–1117, 1 ref. Paris, 13th August 1929.

Notes are given on the influence of irregularity of nutrition, respiration of toxic gases and temperature as factors in determining the diapause in larvae of *Lucilia sericata*, Mg. [*cf. R.A.E.*, B, xvii, 206]. The results of the experiments show that the diapause is induced by external factors, and that any serious disturbance in the life of a larva may retard its metamorphosis within wide limits. Moreover, any modification of environment, however slight, produces an effect on the course of its development.

Cousin (G.). **Les facteurs externes qui déterminent la reprise de l'évolution larvaire de** *Lucilia sericata* **Meig. et leur relation avec les influences extérieures qui ont provoqué la diapause.**—*C. R. Soc. Biol.*, ci, no. 25, pp. 1117–1120, 2 refs. Paris, 13th August 1929.

The larval diapause in *Lucilia sericata*, Mg., is of variable length, and death usually results if environmental conditions remain constant. Development is in most cases resumed with modifications in the environment, and the external factors to which this resumption is due are closely related to those causing its cessation [see preceding paper]. The author has carried out numerous experiments with a great number of individuals under known conditions, and states that the diapause does not appear to be a process of "physiological purification" [*R.A.E.*, B, xi, 55], but merely the manifestation of considerable larval resistance to unfavourable conditions of environment.

KLIGLER (I. J.), MUCKENFUSS (R. S.) & RIVERS (T. M.). **Transmission of Fowl-pox by Mosquitoes.**—*Proc. Soc. Exptl. Biol. & Med.*, xxvi, pp. 128–129, 2 refs. New York, 1928.—*J. Exptl. Med.*, xlix, no. 4, pp. 649–660, 4 pls., 17 refs. New York, 1st April 1929.

The first of these papers is a brief summary of the second, which deals with the transmission of the virus of fowl-pox from infected to healthy susceptible fowls by means of mosquitos. Fowl-pox, which is a common disease that recurs annually in epidemic form throughout numerous countries, is not as a rule extremely fatal, but the falling off of the egg-laying capacity of infected fowls leads to great economic loss. It seems to occur chiefly in the spring and autumn months (though summer epidemics have been observed). Although it is transmissible by direct inoculation and contact infection can undoubtedly occur at times, the mode of its rapid spread under natural conditions had not been satisfactorily explained. The close association of mosquitos and fowls has long been recognised.

In experiments undertaken with *Culex pipiens*, L., and *Aëdes argenteus*, Poir. (*aegypti*, L.), the technique of feeding is described. The feeding on infected fowls was sometimes interrupted, and at different intervals of time after the infective meal the mosquito was fed on normal fowls. Interruptions, either natural or imposed, also occurred during the process of re-feeding, and in this way a single mosquito was found to be capable of infecting a fowl in several places or of infecting more than one fowl. In order to determine the time of survival of the virus, the infective mosquitos were fed on normal fowls at intervals of 3–4 days.

In 7 out of 9 tests, infection occurred in fowls bitten by *C. pipiens* that had fed from 15 minutes to 2 hours previously on the wattles or combs of infected birds. In one of two experiments in which the mosquitos remained alive for several days, a typical infection was produced in a fowl 14 days after the mosquito had taken its infective feed; in the other experiment the fowls on which the mosquito was re-fed were probably already immune from fowl-pox. No lesions occurred when an infective mosquito was macerated and injected into the comb of a susceptible fowl.

Similar experiments with *A. argenteus* did not give such uniformly positive results. Of the re-feedings of 8 mosquitos that took place within 2 hours of the infective meal, only 2 resulted in lesions at points where the insects had bitten. Re-feedings of 3 other mosquitos, 9, 5 and 3 days respectively after the infective feed, produced typical fowl-pox lesions. The many negative results were probably due to the fact that 4 of the 6 fowls employed were subsequently found to be either partly or completely immune. Sufficient positive results were, however, obtained to show that *A. argenteus* is capable of inoculating healthy susceptible fowls with the virus of fowl-pox many days after it has fed on the combs of diseased birds. Results were positive in only one case where macerated infective individuals of *A. argenteus* were injected into healthy fowls.

One experiment was also carried out under conditions approximate to those occurring in nature. Two healthy fowls and one with fresh fowl-pox lesions on its comb and wattles were placed in a mosquito-proof cage with five recently emerged individuals of *C. pipiens*. Seven days later two small lesions appeared on the left wattle of one of the healthy fowls, and these later developed into typical fowl-pox lesions. This bird later acquired immunity, which was probably due to the

infection contracted during the experiment. The other healthy fowl was later found to be immune. In a similar experiment in which no mosquitos were placed with the fowls, the healthy birds were not infected during an observation period of 12 days, even though they frequently pecked at the warty growths on the comb of the infected fowl, and were later shown to be susceptible. The lesions produced by insect inoculation are described. In most epidemics of fowl-pox the lesions occur on the comb and wattles, but in occasional outbreaks most of the manifestations of the disease are found in the mouth and throat, though the mucous membranes are inaccessible to mosquitos and the eating of the virus alone does not usually result in infection.

Tests at intervals longer than two weeks after the infective meal were not made, and the total duration of the infectiveness of the mosquitos has not therefore been determined. In view of the fact that the virus is active in minute quantities and is highly resistant to drying, the results of the experiments can possibly be explained entirely on the grounds that the mosquitos mechanically transmit the disease without the occurrence of any multiplication of the virus in them. Although mosquitos have been shown to be capable of transmitting fowl-pox, experiments should be undertaken in the field to determine whether this mode of transmission is the most inportant one.

MATHESON (R.) & HINMAN (E. H.). **The Vermilion Spotted Newt (*Diemictylus viridescens* Rafinesque) as an Agent in Mosquito Control.**—*Amer. J. Hyg.*, ix, no. 1, pp. 188–191, 3 refs. Lancaster, Pa., January 1929.

Details are given of observations of the newt, *Diemictylus viridescens*, destroying larvae of *Aëdes* sp. (probably *A. stimulans*, Wlk.) in pools, and of subsequent experiments in testing its food capacity, in which single individuals devoured 24 and 45 larvae a day and 25 pupae in 40 minutes. The authors consider that more detailed studies should be made of this newt in relation to its utilisation in destroying mosquito larvae, and of methods of protecting and encouraging its breeding in many parts of the United States and introducing it into foreign countries. It is widely distributed in the eastern and central United States and Canada.

CORY (E. N.) & EATON (N. A.). **Insecticidal Value of Pyrethrum Soaps.**—*Bull. Maryland Agric. Expt. Sta.*, no. 308, pp. 417–428. College Park, Md., April 1929.

Experiments have been made with a proprietary pyrethrum soap insecticide in which approximately 40 per cent. of oleoresin is mixed with 30 per cent. of soap. This was used against *Stomoxys calcitrans*, L., on cows in a barn in Maryland, one lot being sprayed with a dilution of 1 : 200 and the other with 1 : 500. All flies hit with the spray fell to the floor, and flies would not alight on the cattle so long as their hair was wet with the spray. Flies collected from the floor were kept under observation in wire cages ; about 21 per cent. [*sic*] of those hit with the 1 : 200 dilution recovered, and about 4·5 per cent. [*sic*] of those hit with the 1 : 500 dilution.

The same insecticide was tested against larvae of *Culex fatigans*, Wied. (*quinquefasciatus*, Say) in dilutions varying from 1 : 5,000 to 1 : 2,000,000. Ten second instar larvae were placed in each dilution, and all were killed after intervals of time varying from 13 minutes at 1 : 5,000 to 17¼ hours at 1 : 2,000,000. At the latter dilution, no effect was noticed after drinking the water, and the presence of the insecticide could not be detected by taste or smell.

HOWARD (L. O.). **The Work with Mosquitoes around the World in 1928.**—*Proc. 16th Ann. Mtg. New Jersey Mosquito Exterm. Ass., Atlantic City, 1929*, pp. 6–28. New Brunswick, N.J., 1929.

This general review of recent work on the bionomics and control of mosquitos and their relation to disease is on the lines of those for previous years [*R.A.E.*, B, xvii, 136, etc.].

MILLER (F. W.). **A Summary of Mosquito Control Accomplishment in New Jersey during the past Year.**—*Proc. 16th Ann. Mtg. New Jersey Mosquito Exterm. Ass., Atlantic City, 1929*, pp. 28–40. New Brunswick, N.J., 1929.

An account is given of the various activities of the organised mosquito control agencies in New Jersey during 1928 and the results obtained.

BROOKS (J. E.). **The Nature of the Mechanical Appliances developed and used in New Jersey for Mosquito Fighting and the Outlook for wider Use of this Means of Mosquito Control.**—*Proc. 16th Ann. Mtg. New Jersey Mosquito Exterm. Ass., Atlantic City, 1929*, pp. 40–46. New Brunswick, N.J., 1929.

A description is given of various mechanical appliances, chiefly ditch diggers and cleaners, that have been devised and used in New Jersey for the purpose of mosquito control, some of which are considered capable of being improved and more widely used.

VERMEULE (C. C.). **A proposed Solution of the Mosquito and Flood Problem in the Passaic Valley.**—*Proc. 16th Ann. Mtg. New Jersey Mosquito Exterm. Ass., Atlantic City, 1929*, pp. 46–50. New Brunswick, N.J., 1929.

Following a thorough survey during the past year, a scheme of drainage is outlined for the Passaic Valley which it is hoped will solve the mosquito problem in that region.

GINSBURG (J. M.). **Relation between Toxicity of Oil and its Penetration into Respiratory Siphons of Mosquito Larvae.**—*Proc. 16th Ann. Mtg. New Jersey Mosquito Exterm. Ass., Atlantic City, 1929*, pp. 50–63, 2 pls., 4 refs. New Brunswick, N.J., 1929.

In order to determine whether death by suffocation is caused to all larvae and pupae of mosquitos in water covered by a film of any kind of oil, or whether the oil must possess certain toxic properties, the toxicity and penetration of a number of petroleum oil distillates varying in boiling points from 200 to 700° F., and of different volatilities and

viscosities, were tested. Penetration was tested by keeping larvae and pupae in water under films of oils containing an oil-soluble dye insoluble in water and then removing, washing, and transferring them to slides under a microscope. The methods and results of the experiments are described in detail, and the following conclusions are reached: The toxicity of petroleum distillates is directly proportional to the rate of volatility and inversely proportional to the boiling point. From the standpoint of mosquito control, the petroleum distillate oils can be divided into two groups, namely, oils of low boiling points and high volatility possessing high toxicity to larvae and pupae, and oils of high boiling points and low volatility possessing little or no toxicity to larvae or pupae. Oils boiling from 200 to 550° F. kill larvae and pupae within 30 minutes or less by exerting a direct toxic effect. Oils of higher boiling ranges, such as lubricating and similar oils, cause the death of larvae and pupae by suffocation. The rate of kill of these non-toxic oils is proportional to the thickness of the film. Larvae of which the respiratory siphons are filled with non-toxic oil do not develop into pupae. Pupae of which the trumpets and part of the thorax are filled with non-toxic oils can, under certain conditions, develop into adults. The breathing tubes of larvae and trumpets of pupae can readily penetrate such thin oil films as are usually applied on mosquito-breeding places. For efficient mosquito control work in the field, the oil must not only form a uniform film but must also be directly toxic to the larvae and pupae.

STALLMAN (M. M.). **The Application of Law to Mosquito Control; the Nature of Legal Principles involved and the Process of their Application to the Problem of Mosquito Control.**—*Proc. 16th Ann. Mtg. New Jersey Mosquito Exterm. Ass., Atlantic City, 1929*, pp. 68–73. New Brunswick, N.J., 1929.

The various laws relating to mosquito extermination in New Jersey since the first legislation in 1905 are reviewed. By a statute of 1927, the State requires the owner of mosquito-breeding lands to abolish a mosquito nuisance if such a course is feasible and practicable, and the Director of the State Experiment Station is required to specify how the work should be done.

HEADLEE (T. J.). **The Relation of Rainfall to the seasonal "Peak Load" of Mosquito Control.**—*Proc. 16th Ann. Mtg. New Jersey Mosquito Exterm. Ass., Atlantic City, 1929*, pp. 74–82, 5 charts. New Brunswick, N.J., 1929.

The principles governing the incidence of maximum mosquito breeding are discussed, and an effort is made to apply these principles to practical experience in New Jersey during the years 1914 to 1928. The records during these years are shown on charts, and these demonstrate that the fundamental factor underlying maximum mosquito breeding on uplands is rainfall, when sufficient in amount to keep temporary pools and containers everywhere filled with water and to overcome soil absorption and evaporation. A graphical record of the curve of rainfall in conjunction with the curve of soil absorption and evaporation should therefore, as the season progresses, show the problem to be solved and the time when the campaign must be most strenuous. With the present equipment and organisation, the author considers

that, so long as the seasonal conditions are not more than moderately wet, or even when part of the season is very wet, the maximum breeding can be kept in check, but when the entire season is very wet this is impossible.

PETERSON (J. P.) & GINSBURG (J. M.). **Two Years' Study and practical Use of Crankcase Waste Oil as a Mosquito Larvicide.**—*Proc. 16th Ann. Mtg. New Jersey Mosquito Exterm. Ass., Atlantic City, 1929*, pp. 92–101, 2 pls., 6 refs. New Brunswick, N.J., 1929.

An account is given of experiments and field observations showing that crank case oil can be efficiently used against mosquito larvae. The oil almost always requires straining, and apparatus for doing this is described. It does not in itself spread on water, but may be made to do so by the addition of a spreader such as tar acid (containing 25 per cent. cresylic acid) or by adjusting the specific gravity of the oil to 32 or 34° Bé. by the addition of light petroleum distillates. Of these, one of the most satisfactory was found to be a waste product obtained from " varnolene," which is used as a solvent in the varnish industry, etc. It is a low boiling petroleum distillate and possesses the following specifications: Bé. gravity 46·8°; flash point 96° F. closed cup; 160° F. open cup; boiling range 300–417° F. Like tar acid, it is itself highly toxic to mosquito larvae, whereas crank case oil is not. The lasting quality of the oil mixture is from 2 to 4 weeks, or twice as long as that of fuel oil, and the cost is about half that of the latter.

A method of calculating the amounts of the two oils to be mixed that are required to obtain a mixture of a given specific gravity is described.

GIBSON (A.). **Mosquito Suppression in Canada in 1928.**—*Proc. 16th Ann. Mtg. New Jersey Mosquito Exterm. Ass., Atlantic City, 1929*, pp. 102–108. New Brunswick, N.J., 1929.

The mosquito situation in the various provinces of Canada is briefly outlined. In Ontario, oiling measures at Camp Borden have given very encouraging results, and it is planned to continue the work next year. The comparatively low level of the Ottawa river in 1927 prevented an outbreak of the flood water mosquito, *Aëdes vexans*, Mg., but the heavy rains throughout the summer of 1928 maintained flood conditions and in many places made oiling impossible. The exceptionally high level of the river, however, caused great numbers of larvae to be carried into open deep water, where they perished owing to the presence of fish and other factors. Much underbrush has to be cut away to provide access to breeding-places.

In a few experiments, pyrethrum and derris dusts were applied by a dust-gun as mosquito larvicides to test their possible value for distribution by aeroplane. Both dusts are easily carried away by wind. The general impression gained was that to be effective they should be used against immature larvae, their action on mature larvae and pupae being apparently too slow for efficient control. The results with pyrethrum powder were rather conflicting. In one pool, heavily infested with *A. stimulans*, Wlk., and immature, unidentified larvae of another species, this dust at the rate of 9 lb. per acre gave almost complete control within 26 hours. Other pools, containing large numbers of mature larvae of *A. vexans*, were dusted at varying strengths

up to 15 lb. per acre, but the insecticide appeared to have little or no effect. Derris was even less satisfactory. A heavy infestation of mature larvae and some pupae of *A. stimulans*, *A. fitchi*, Felt & Young, *A. excrucians*, Wlk., and *A. cinereoborealis*, Felt & Young, was considerably reduced by dusting with derris at the rate of 5 lb. per acre, but after 5 days many larvae and pupae were still present and adults were emerging.

GRIFFITTS (T. H. D.). **Salt Marsh Vegetation in Relation to Salt Marsh Mosquito Breeding in the South Atlantic and Gulf States.**—*Proc. 16th Ann. Mtg. New Jersey Mosquito Exterm. Ass., Atlantic City, 1929*, pp. 108–116. New Brunswick, N.J., 1929.

It has been found that certain plants associated with the different types of salt marshes are a more or less exact index to the breeding and production of the salt marsh species of *Aëdes*, *Culex* and *Anopheles*. The flora of the salt marshes in the South Atlantic and Gulf States is reviewed from this aspect.

BARBER (M. A.), KOMP (W. H. W.) & NEWMAN (B. M.). **Observations and Experiments in the Panama Division of the United Fruit Company, with special Reference to certain Measures for the Control of Malaria.**—*17th Ann. Rep. Med. Dept. United Fruit Co. 1928*, pp. 34–51, 12 refs. Boston, Mass., 1929.

Investigation has shown that plasmochin has a selective action on the gametocytes of malaria, its destructive action on the crescents of malignant tertian [*Plasmodium falciparum*] especially being more effective than that of any other drug. The experiments described were undertaken to determine the effect of small doses of plasmochin on the viability of gametocytes in mosquitos. In all experiments, *Anopheles albimanus*, Wied., was used because of its susceptibility to malaria parasites and its readiness to bite man. The mosquitos were fed only once on a given carrier, and in no case did they become infected after plasmochin treatment. It appears that single doses as small as 0·2 mg. per kg. of body weight may affect the viability of crescents even though they have increased in numbers and are still living and capable of exflagellation. All cases from which conclusions were drawn were of malignant tertian and had successfully infected mosquitos prior to the plasmochin administration. It is suggested that the use of small doses of plasmochin among a population would be safe and effective in reducing the transmission of malaria.

From mosquito surveys carried out in 1928 and 1929 in Panama, it appeared that *Anopheles albimanus*, the chief malaria carrier of the region, is capable of adapting itself to a greater variety of breeding-places than is generally recognised. The preferred ones are collections of fresh or brackish water, open to the sun and not too much fouled by decaying vegetation, but in dry weather at least it may adapt itself to deep ditches or even clear streams. It is obviously impracticable to carry out larvicidal work in large areas of jungle surrounding a camp, but the author points out the importance of determining the effect of such larvicidal measures as are undertaken on the density of the adult Anophelines (by counts of mosquitos in dwelling or resting places near them), since it is useless to continue local larvicidal work

without considering larger breeding-places within easy flight range. Should control in such areas prove impracticable, some anti-malaria measure other than larvicidal treatment should be employed. The effective flight range of *A. albimanus* is therefore a matter of importance, and observations indicate that any large breeding-places within ½ mile at least must be treated if effective larvicidal work is attempted. Moreover, infected mosquitos may fly from a village where a high malaria rate is associated with local breeding to more distant localities. Swamps overgrown with weeds do not always produce *A. albimanus*, and in such areas mosquito counts may save unnecessary expense. The numbers of Anophelines should measurably decrease within ten days or two weeks after a successful anti-larval campaign.

Malaret (P. S.). **The Control of Malaria in the Preston Division.**—*17th Ann. Rep. Med. Dept. United Fruit Co. 1928*, pp. 83–94. Boston, Mass., 1929.

An account is given of the successful results of an anti-malaria campaign carried out in a cane-growing, sugar-manufacturing area on the north-eastern coast of Cuba during the years 1926–28. *Anopheles albimanus*, Wied., is the important vector of malaria, *A. vestitipennis*, D. & K., *A. grabhami*, Theo., and *A. crucians*, Wied., the other three species of Anophelines recorded from Cuba, being rare in this locality. During the day, the adults are difficult to find, and although they may occasionally be seen in human habitations, they apparently prefer to rest in the cane-fields, only visiting houses at night to obtain a blood-meal. Clear water is preferred for breeding, and sluggish rivers, streams and creeks, with mats of algae on the surface to protect the larvae from fish, are favoured. The usual control measures, such as the draining of breeding-places, the use of larvicides (particularly Paris green) and the administration of quinine to malaria patients, were employed.

Chorine (V.) & Baranoff (N.). **Sur deux champignons parasites d' *Anopheles maculipennis* Mg.**—*C.R. Soc. Biol.*, ci, no. 25, pp. 1025–1026. Paris, 13th August 1929.

Among larvae of *Anopheles maculipennis*, Mg., collected in the vicinity of Zagreb, Croatia, were a certain number of individuals dead or dying of a disease caused by a fungus of the family Saprolegniaceae, which was subsequently isolated on Sabouraud's medium. In an experiment 10 larvae of different sizes were placed in a vessel containing water with a dead larva covered with the fungus. Four days later one pupa and two larvae were dead, and the others died in the three following days, whereas the larvae in a control vessel developed into normal adults. Another fungus of the same family was isolated from larvae of *Simulium* (*Odagmia*) *ornatum*, Mg., and in an experiment similar to the one mentioned above, it also infected the larvae of *A. maculipennis*, though to a less degree than the first one. Infection is produced in both cases by means of motile zoospores, which begin to leave the sporangia the day after the death of the larva, and swim freely in the water until they encounter another one. Meanwhile many are eaten by Infusoria, which are always present in large numbers near larvae killed by the fungus, and it is evident that the propagation of the disease is limited to a certain extent by these Protozoa.

Del Guercio (G.). **Il male del giallume (o dei Microbi poliedrici) negli allevamenti dei filugelli, negli insetti delle piante forestali ed agrarie e nelle zanzare della malaria.** [Grasserie (or the polyhedral Microbe Disease) in Silkworm Broods, in Insect Pests of Forests and Agriculture and in malarial Mosquitos.]—*Redia*, xvii, pp. 1–296, 313–315, 14 figs., 13 pls., 31 pp. refs. Florence, 12th July 1929.

This treatise on the importance of polyhedral diseases of insects caused by *Entomococcus* spp. [*R.A.E.*, A, xvii, 686] contains a chapter on these diseases in mosquitos, which also includes a review of the various measures employed for mosquito control. *Entomococcus berlesianus* was described by the author in 1926 from *Anopheles hyrcanus* var. *pseudopictus*, Grassi, *A. superpictus*, Grassi, and *Culex* in Italy. *E. anopheliperda*, sp. n., also infects *Anopheles* and *Culex* in Italy. These organisms occur only in mosquitos and can infect any of the stages from egg to adult. They can also destroy the malarial *Plasmodium* in the mosquito. *E. anopheliperda* appears also to have been observed by Grassi.

Shute (P. G.). **The Effect of severe Frost on Larvae of *Culicella morsitans* (Diptera, Culicidae).**—*Entomologist*, lxii, no. 798, pp. 243–244, 2 refs. London, November 1929.

In England, *Theobaldia* (*Culicella*) *morsitans*, Theo., usually passes the winter in the larval stage. In experiments, larvae exposed to the open air until the water in the bowl had been solid ice for three days were found to have died. After a severe frost, observations of a pond, where the larvae of *T. morsitans* had been extremely abundant in the previous autumn, revealed only 5 living individuals, and it is supposed that these happened to be in the middle of the pond, where it was too deep to be completely frozen. The finding of dead larvae of *Aëdes* (*Ochlerotatus*) *rusticus*, Rossi, indicates that this species also is unable to survive in solid ice.

In a footnote F. W. Edwards states that larvae of *Anopheles bifurcatus*, L., that had been frozen into a solid block of ice for several days recovered in most cases, and it is probable that being surface feeders they are more liable to freezing than bottom feeders (such as *Theobaldia*) and therefore exhibit a greater resistance to cold.

Garnham (P. C. C.). **Malaria in Kisumu, Kenya Colony.**—*J. Trop. Med. Hyg.*, xxxii, nos. 15–16, pp. 207–216, 221–231, 12 figs., 48 refs. London, 1st & 15th August 1929.

This review of malaria in Kisumu deals with a mosquito survey of the district, records of the local incidence of the disease and gives a brief account of the measures adopted for its control.

In addition to *Anopheles mauritianus*, Grp., *A. gambiae*, Giles (*costalis*, Theo.) and *A. pharoensis*, Theo., all of which had been previously recorded from Kisumu, the following species have been identified: *A. funestus*, Giles, *A. pretoriensis*, Theo., *A. squamosus*, Theo., *A. maculipalpis*, Giles, *A. symesi*, Edw. [*R.A.E.*, B, xvi, 93], and a probable new species, somewhat resembling *A. transvaalensis*, Cart., but with markedly different larval characteristics. The general

and specific breeding-places of the various Anophelines found are analysed and the pH values are given. Adults of both sexes of *A. gambiae*, hitherto believed to leave the pupal case only at night, were observed to emerge between 12 noon and 3.30 p.m. in the strong light of the laboratory. The larva of *A. symesi* is described. Microscopic examinations of the larvae of *A. funestus* showed two definite morphological types, the adults bred from which were apparently identical. It was found that Anophelines did not breed in the Victoria Nyanza itself, where its edges are sharply defined, or in water tanks and roof gutterings, axils of plants, holes in trees, certain types of pools, and water from kitchens or bathrooms containing soap. The characteristics of the papyrus swamp, which is one of the most prolific breeding grounds, are indicated in relation to the larvae found in it.

Counts of Anopheline adults indicated the inadequacy of larval counts for the determination of domestic adult prevalence. The results of weekly examinations of 25 huts from March 1926 to January 1928, which are shown in graphs, indicate a consistently high level of *A. funestus* and a marked seasonal production of *A. gambiae*. The incidence of *A. funestus* bears no relation to rainfall, whereas *A. gambiae* appears with the spring rains and at no other times, not even after other rainy periods, though the larvae were found in considerable numbers in the dry season. Variation in the density of *A. funestus* is in direct proportion to the proximity of its breeding-places, but no such relationship was observed in the case of *A. gambiae*, the production of which is essentially dependent on temporary breeding-places. Dissections showed very low sporozoite and oöcyst rates of domestic *A. gambiae* and *A. funestus*. Dissections of salivary glands indicate that abnormalities of these may be evidences of degeneracy. Morphological variations of this kind are thought to be the result of unfavourable environment [*R.A.E.*, B, xiv, 15], and may increase the ability of the mosquito to transmit malaria. It was found that *A. gambiae* and *A. funestus*, the only domestic species in Kisumu, definitely do not shelter in vegetation, although other species were observed to do so. They enter dwellings between 5 and 6 a.m., but avoid houses where fires are maintained. The proportion of males is greater in uninhabitated houses and near breeding-places. Studies of dispersal by means of the release of stained mosquitos over a period of two years suggested a slight daily accumulation rather than complete redistribution.

The mean temperature and relative humidity are shown for each month of the three years 1925–1927, and the rainfall curve is shown in relation to the monthly occurrence of malaria.

The predominating variety of the disease in Kisumu is malignant tertian, though cases of benign tertian and, more rarely, of quartan also occur. The most malarial months in 1926 and 1927 were May, June and July. Seasonal rises follow the spring rains, and are therefore dependent upon the sudden appearance of *A. gambiae*. The density of *A. funestus*, the probable vector of endemic malaria, does not appear to influence the number of cases above a certain minimum. Seasonal variations in the parasite rate are probably due to the sudden appearance and disappearance of *A. gambiae*, but local variations are dependent not on Anopheline density, but on the habits of the people concerned.

Control measures, which are briefly reviewed, apart from the treatment of the disease, are mainly confined to the destruction of adult Anophelines in houses, etc., the abolition of breeding-places in the

immediate vicinity of the town by proper drainage, intensive oiling in the rainy season, and the provision of native and cattle barriers between the chief breeding-places and the main town. Any attempt to eradicate the chief breeding grounds in the papyrus swamps does not appear feasible.

KLIGLER (I. J.) & LIEBMAN (E.). **Studies on Malaria in an Uncontrolled Hyperendemic Area (Hule, Palestine). Changes in the Resting Places of *Anopheles* with special Reference to Infected Mosquitoes.**—*J. Preventive Med.*, ii, no. 5, pp. 433–440, 5 refs. Baltimore, Md., September 1928. (Abstract in *Trop. Dis. Bull.*, xxvi, no. 5, pp. 364–365. London, May 1929.)

Of Anophelines taken in houses, 69 per cent. contained human blood, 23 per cent. that of cows, and 8 per cent. that of equines. All individuals of *Anopheles sacharovi*, Favr (*elutus*, Edw.) infected with malaria (5·4 per cent.) were found in houses from June to September. In October and December infection in those in stables was twice as high as in houses. Of *A. superpictus*, Grassi, considerable numbers were found infected in stables throughout the year, but particularly during the summer epidemic period. These species of mosquitos do not then stay where they have fed.

HAGA (J.). **Over filariasis in Ned.-Indië, met name op de Westkust van Sumatra en de Zuider- en Ooster-Afdeeling van Borneo (Onder-afdeeling Zuid-Hoeloe-Soengai).** [Filariasis in the Dutch East Indies, particularly in the West Coast of Sumatra and in the South-east of Borneo (Subdivision South Hoeloe-Soengai).]—*Geneesk. Tijdschr. Ned.-Indië*, lxix, no. 8, pp. 763–771, 1 table. Weltevreden, 1st August 1929.

The incidence of filariasis in western Sumatra is discussed. In South Hoeloe-Soengai, Borneo, *Taeniorhynchus* spp., which bite readily, appear to be the vectors of the disease, other Culicines being rare. *T.* (*Mansonioides*) *uniformis*, Theo., *T.* (*M.*) *annuliferus*, Theo., and *T.* (*M.*) *annulipes*, Wlk., are the common species. Cases of filariasis are described, but whether they are due to *Filaria* (*Microfilaria*) *bancrofti* or *F.* (*M.*) *malayi* [*R.A.E.*, B, xvi, 41] is doubtful.

MANSELL (R. A.). **Some Answers to the Cantonment Antimalaria Problem.**—*J. Roy. Army Med. Corps*, liii, no. 3, pp. 196–201. London, September 1929.

The author discusses the problems of malaria control in cantonments in India [*R.A.E.*, B, xvi, 246] with a view to showing that the measures at present carried out against mosquitos are justified by results. Diagrams are given showing the decline in the incidence of the disease during the years 1923–28. Recently, sums amounting to £15,000 annually have been alloted to the army for anti-malaria work in cantonments. In one district alone, where the expenditure over four years has amounted to about £11,000, the number of British and Indian troops admitted to hospital for malaria has been reduced by 3,300

and 1,900 respectively, though this is probably not entirely the result of the measures taken. A spray against adult mosquitos made by dissolving 48 naphthalene balls in 1 gal. paraffin, devised by K. M. Bharucha, is much cheaper than proprietory sprays, though a little less rapid in action. Experiments by J. B. Hanafin show that mosquitos can be destroyed by fumigating with from 2 to 5 oz. of rapidly vapourised cresol to 1,000 cu. ft. in barrack rooms that have been closed but not sealed.

LOUGHNAN (W. F. M.). **Phlebotomus Flies in Mauritius.**—*J. Roy. Army Med. Corps*, liii, no. 3, pp. 202–205, 4 refs. London, September 1929.

Considerable numbers of *Phlebotomus africanus*, Newst., were captured in Port Louis, Mauritius, between December 1928 and April 1929. No species of this genus had previously been recorded from the Island. The sandflies were found in damp, shady, whitewashed barrack rooms on the ground floor, where the temperature averaged 70–80° F., and where they were not disturbed by air currents. The topography and climate of Port Louis are discussed. Dengue has been recognised in Mauritius for a number of years, and *Aëdes argenteus*, Poir., and *Culex fatigans*, Wied., are common. Cases of undetermined fever of short duration of a similar type also occur that may possibly be sandfly fever or atypical dengue.

[DANILOV (B. A.).] **Данилов (Б. А.). Observations on hibernating Quarters of the Adults of Mosquitos in the Town of Old Tashkent and its Environs.** [*In Russian.*]—*Meditz. Muisl' Uzbekistana*, vii, no. 1, pp. 51–60, 30 refs. Tashkent, October 1928. (With a Summary in French, p. 101.)

In the course of these observations, carried out from September 1925 till May 1928 in or near the town of Old Tashkent, mosquitos were usually found hibernating in quarters situated in the vicinity of their breeding-places, usually not further than 100 yards away. The mass flight of the mosquitos in search of hibernating quarters took place at the beginning of November. No Anophelines were ever observed on the wing in the open air at a temperature of 6° C. [42·8° F.]. Most of the hibernating mosquitos were found in uninhabited dwellings and clay storehouses of the native type ; in diminishing numbers they also occurred in stables, cowsheds, cellars, etc. The character of these quarters is briefly described. A migration of mosquitos during the hibernation period from colder quarters to warmer ones has been observed several times, and two such cases are described. The condition of mosquitos during hibernation depends on the temperature ; although they can survive at a low temperature, they are killed by sudden fluctuations within a short period of time. They usually resume activity in March, the actual date depending on the temperature of the hibernation quarters. Of the Anophelines observed *Anopheles sacharovi*, Favr, was prevalent, *A. superpictus*, Grassi, and *A. hyrcanus*, Pall., occurring only as single individuals.

[Sofiev (M. S.) & Shevchenko (F. I.).] **Софиев (М. С.) и Шевченко (Ф. И.). The Vitality of *Leishmania canis* in the digestive Tract of *Phlebotomus papatasii* (Scop.).** [*In Russian.*]—*Meditz. Muisl' Uzbekistana*, viii, no. 5, pp. 48–55, 1 pl. Tashkent, February 1929. (With a Summary in French, p. 100.)

This is a description of experiments carried out in Tashkent in which the females of *Phlebotomus papatasii*, Scop., were fed on two dogs, one of which suffered from cutaneous leishmaniasis and the other also from the visceral form of the disease. In each case the sandflies were placed on the nose of the animal, at the edge of a sore, in a cylinder of about 2 ins. in diameter, to one end of which a small funnel was fixed, the opposite end being covered with a piece of fine-meshed copper gauze ; they were introduced into the cylinder through the funnel and readily fed through the gauze. Prior to dissection, they were kept in the same cylinder for from 24 hours to 8 days in a cellar at a temperature of 21–28° C. [69·8–82·4° F.], being fed with sugar and water after the third day. The percentage of sandflies containing *Leishmania* in the digestive tract was 96 on the first day after the feeding, 69·2 on the second, 61·5 on the third, and only 2·7 on the sixth ; a rise was observed on the seventh and eighth days, when the figures were 4 and 4·05 respectively.

The development of the parasites in the digestive tract of the sandflies is discussed in detail. During the first 14–19 hours they retained forms similar to those that occurred in the sores and internal organs of the infected dogs ; flagellated forms developed after 24 hours only, and elongate ones on the third day. Simultaneously with a decrease in the numbers of the normal forms, and up to the sixth day, degenerate ones became more numerous.

On the basis of these observations, the author concludes that the fact that the parasites penetrate into the stomach of *P. papatasii* does not normally suffice for their further development and subsequent infection of the insect host, since after the fifth day only a few of them remain capable of development, and not more than 3·6 per cent. of the sandflies on the average remain infected. The cause of the destruction of the parasites in the digestive tract of *P. papatasii*, and the question whether those that do complete their cycle of development are pathogenic, and from what moment, should be carefully studied.

McKinley (E. B.). **Filterable Virus and Rickettsia Diseases.**—*Philipp. J. Sci.*, xxxix, pp. 1–416, 70 pls., 7 figs., numerous refs. Manila, 1929.

This extensive study on filtrable virus diseases includes chapters on insect-borne diseases such as yellow fever and dengue, on the *Rickettsia* diseases of man and animals such as typhus, Rocky Mountain spotted fever, etc., which are transmitted by various Arthropods, and on diseases of insects. A chapter is also included on virus diseases of plants. A bibliography is appended to the section dealing with each disease.

McKinley (E. B.). **Filterable Virus and Rickettsia Diseases in the Tropics. V.**—*Porto Rico Rev. Publ. Hlth. & Trop. Med.*, iv, no. 11, pp. 538–580, 89 refs. San Juan, P.R., May 1929.

This paper deals with the diseases of man caused by *Rickettsia* and insect-borne filtrable viruses, the information being taken from the preceding paper.

Borel (E.). **Les moustiques de la Cochinchine et du Sud-Annam.**—*Arch. Inst. Pasteur Indochine*, no. 9, pp. 23–82, 26 pls. Saigon, April 1929.

In this fourth part of a detailed account of the mosquitos of Cochin China and South Annam [*R.A.E.*, B, xvi, 250; xvii, 116] the author deals with the Anophelines, which he divides into the subgenera *Anopheles* and *Myzomyia*, the latter containing the groups *Pseudomyzomyia*, *Neocellia* and *Neomyzomyia*. Keys are given for the determination of the larvae and adults, and the habits of both larvae and adults are shown in tabular form. Descriptions are given of both sexes of the adult and of the larva of most of the 16 species and varieties dealt with.

Olmer (D.). **Nouvelles observations et recherches sur la "fièvre exanthématique."**—*Bull. Acad. Méd.*, (3) c, pp. 996–999. Paris, 1928.

Further observations are given on Marseilles fever [*R.A.E.*, B, xvii, 62]. The supposition that it is an unrecognised form of dengue is rejected, one reason being that *Aëdes argenteus*, Poir. (*Stegomyia fasciata*, F.) is only found very exceptionally at Marseilles and does not appear capable of breeding there. The disease occurs only in the hot season and is very common in the countryside, where dogs are always in the immediate vicinity of the patients. These dogs are commonly infested by *Ixodes ricinus*, L., and it is suggested that they are reservoirs of the disease and that it is transmitted by the tick.

Barreto (J. de B.) & Peryassú (A. G.). **Da aspersão de insecticidas na prophylaxia da febre amarella.** [The Spraying of Insecticides in the Prophylaxis of Yellow Fever.]—*Brasil-Medico*, xliii, no. 13, pp. 350–359. Rio de Janeiro, 30th March 1929.

The destruction of mosquitos [*Aëdes argenteus*, Poir.] indoors as a prophylactic measure in the campaign against yellow fever in Rio de Janeiro was first carried out by fumigating with sulphur, 1,411 houses being so treated between June and August 1928. The disadvantages of this method led to experiments with various sprays, as a result of which kerosene containing 3·5 per cent. of carbon tetrachloride was used with compressed air sprayers, 14,071 houses being treated from August to December. The spray was used at the rate of 15 cc. per cubic metre in the case of perfectly sealed rooms and 21–25 cc. for rooms less completely closed.

La Face (L.) & Raffaele (G.). **Sulla presenza della "*Stegomyia fasciata*" nell'Italia meridionale e in Sicilia.** [On the Occurrence of *Aëdes argenteus* in South Italy and Sicily.]—*Policlinico*, Sez. prat., xxxv, no. 43, p. 2095. Rome, 29th October 1928.

Aëdes argenteus, Poir. (*Stegomyia fasciata*, F.) has been recorded from various parts of Italy, Sicily and Sardinia, but it was not known whether it occurred along the costs of South Italy and whether it was common along the east coast of Sicily. Its occurrence at Bari [*cf. R.A.E.*, B, xvii, 78], Brindisi and Taranto, and in several places on the east coast of Sicily is here recorded.

IYENGAR (M. O. T.). **Adult and Larval Stages of** *Anopheles majidi*.—*Ind. J. Med. Res.*, xvii, no. 1, pp. 1–10, 1 pl., 2 figs., 5 refs. Calcutta, July 1929.

On the basis of a study of numerous specimens from both North and South India, both sexes of the adult and the larva of *Anopheles karwari* var. *majidi*, Young and Majid, are re-described, and it is considered a distinct species. The characters distinguishing the females of the three allied Indian species, *A. maculatus*, Theo., *A. majidi* and *A. karwari*, James, are indicated, *A. maculatus* var. *dravidicus*, Chr., and *A. willmori*, James, being included with *A. maculatus* for the purposes of this comparison. The modifications in Christophers' key [*R.A.E.*, B, xiii, 109] necessary to include *A. majidi* are indicated. The distribution of this species, which has hitherto been recorded only from Coorg, in South India, and from the foot-hill zone of the Himalayas, is given. The larvae were found with those of *A. maculatus*, *A. jeyporiensis*, James, and *A. minimus*, Theo., in small open drains with an abundance of aquatic vegetation in tea gardens in the sub-montane region of the Bengal Duars. They have also been observed in water lying in old terraced rice plots.

MAYNE (B.). **The Nature of the "Black Spores" associated with the Malaria Parasite in the Mosquito and their Relationship to the Tracheal System.**—*Ind. J. Med. Res.*, xvii, no. 1, pp. 109–134, 4 pls., 35 refs. Calcutta, July 1929.

The following is taken from the conclusions drawn by the author from this study: The "black spores," originally described by Ross, are not parasites, nor are they any stage in the development of the malaria parasite in the mosquito. The hypothesis of Grassi and other workers that these bodies are concerned with "regression or involution" processes of the oöcyst is not confirmed nor that lower temperatures favour their production. They have been found during experiments with malaria in uninfected as well as in infected mosquitos. They have also been observed in freshly emerged, unfed, laboratory-bred females and males of *Anopheles* and *Culex*, and in houseflies, *Musca* sp. They react to the chitin test, and most, if not all, of them appear to be chitinogenous thickenings of the tracheal tubes.

STRICKLAND (C.). **The relative malarial Infectivity of some Species of Anophelines in Cachar (Assam).**—*Ind. J. Med. Res.*, xvii, no. 1, pp. 174–182, 3 refs. Calcutta, July 1929.

This paper summarises the results of the dissection, between April and December 1927, of a large number of mosquitos collected in human habitations in the Assam tea gardens. The numbers of the species dissected are given in brackets after their names. Infection with malarial parasites was found in 58 instances in *Anopheles funestus*, Giles (1,489), and once each in *A. kochi*, Dön. (535), *A. vagus*, Dön. (1,341) and *A. karwari*, James (1,697). It was not found in *A. maculatus*, Theo. (147), *A. jeyporiensis*, Theo. (125), *A. culicifacies*, Giles (1), *A. tessellatus*, Theo. (6), *A. aconitus*, Dön. (136), *A. fuliginosus*, Giles (51), *A. philippinensis*, Ludl. (2,410), *A. hyrcanus*, Pall. (1,757), *A. jamesi*, Theo. (8), *A. barbirostris*, Wulp (2), *A. aitkeni*, James (3), and *A. leucosphyrus*, Dön. (36).

ADHIKARI (A. K.). *A. aitkenii* **James in Vizagapatam Agency, Madras Presidency.**—*Ind. J. Med. Res.*, xvii, no. 1, pp. 214–215, 4 refs. Calcutta, July 1929.

Larvae of *Anopheles aitkeni*, James, which has not previously been recorded from the wide area lying between Chota Nagpur on the north-east and the Nilgiri Hills in the south, were repeatedly found early in 1928 in a slow-running forest stream in the Vizagapatam Agency, Madras Presidency. The stream was completely shaded by trees, through which the sun penetrated for only short periods. Most of the larvae were found in indentations in the banks, the water being cool, clear and free from weeds or algae. A description of the larva is given.

FEEGRADE (E. S.). **Experiments to note the larvicidal Effects, if any, of Sodium Nitrate, Potassium Nitrate, and Magnesium Sulphate in natural Waters.**—*Ind. J. Med. Res.*, xvii, no. 1, pp. 249–250. Calcutta, July 1929.

In these experiments, which were carried out in Rangoon in May and June 1928 to ascertain the possible larvicidal qualities of salts commonly found in water either alone or in combination, mature larvae of *Aëdes argenteus*, Poir., were used, and 1,000 cc. of water, the analysis of which is given, was taken in each case from the same spot in a specific tank and placed in glass jars. The addition of 0·2–25 gms. potassium nitrate produced no fatal results, and even with 30 gms. the lethal effect on the larvae was spread over a period of 48 hours. Sodium nitrate up to 30 gms. had no effect, but a combination of 10 gms. potassium nitrate and 8 gms. sodium nitrate proved fatal in 48 hours. A combination of 8 gms. magnesium sulphate and 10 gms. potassium nitrate killed the larvae in 17 hours.

SMITH (R. O. A.). **Two Species of *Culicoides* which feed on Man.**—*Ind. J. Med. Res.*, xvii, no. 1, pp. 255–257. Calcutta, July 1929.

The females of *Culicoides actoni*, sp. n., and *C. raripalpis*, sp. n., are described from Burnihat in Assam, where they attack man. Large numbers of *Culicoides* and one species of *Lasiohelea* were captured feeding on cattle in a shed in the same village. They included *C. actoni*, *C. oxystoma*, Kieff., and *C. anophelis*, Edw., and two undescribed species that resembled *C. oxystoma*.

BARRAUD (P. J.). **A simple Method for the Carriage of living Mosquitoes over long Distances in the Tropics.**—*Ind. J. Med. Res.*, xvii, no. 1, pp. 281–285, 1 fig. Calcutta, July 1929.

An apparatus for transporting mosquitos which has proved successful under circumstances of very high temperature and relative humidity in India is described. A framework is constructed by tying firmly together at the corners with tapes six squares of strong wire measuring about 6 inches along each side. On the inside of this frame a cage of small mesh mosquito netting is fastened by means of tape sewn to the corners of the net, to one side of which a small sleeve is attached, large enough to admit a test-tube. This cage is placed in a wooden box. The mosquitos are introduced into the cage through the sleeve, which

is then secured with tape. A folded pad of wet lint is placed at the bottom of the box, the pad being sufficiently thick to press against the bottom of the mosquito netting. For the nourishment of the mosquitos some raisins are deposited on the top of the cage and kept in place by a thick pad of cotton wool filling up the space between the top of the cage and the lid of the box, which is attached by only one screw so that it can be turned to one side and the cage readily removed. The lid is firmly secured to the box with tape or webbing and the whole done up with brown paper. The tabulated results of 10 experimental consignments of mosquitos by this method are given, 80 per cent. of the total number of mosquitos despatched surviving transmission, and 4 of the batches arriving without casualities, though one of them travelled 3,880 miles by parcel post. Further tests include the transmission to London of 22 mosquitos of various species, 11 of which survived the journey of 6,000 miles occupying 16 days.

Papers noticed by Title only.

Kemper (H.). **Beitrag zur Kenntnis des Stinkapparates von** *Cimex lectularius*, **L.** [Contribution to the Knowledge of the Stink-gland of *C. lectularius*.]—*Z. Morph. Oekol. Tiere*, xv, no. 3, pp. 524–546, 9 figs., 21 refs. Berlin, 1929.

Lefrou (G.). **Contribution à l'étude de la peste au Cayor** [Sénégal] **en 1928.**—*Bull. Soc. Path. exot.*, xxii, no. 6, pp. 506–520, 1 map, 2 refs. Paris, 1929. [*Cf. R.A.E.*, B, xvii, 202.]

Webster (W. J.). **The Anatomy of the Indian** *Xenopsylla* **Larvae.**—*Ind. J. Med. Res.*, xvii, no. 1, pp. 90–93, 1 pl., 3 refs. Calcutta, July 1929.

Feegrade (E. S.). **Observations on the Markings of** *A*[*nopheles*] *jamesii* **Theobald.**—*Ind. J. Med. Res.*, xvii, no. 1, pp. 251–252. Calcutta, July 1929.

Feegrade (E. S.). **Some more Variants of** *A*[*nopheles*] *fuliginosus* **Giles, from Burma.**—*Ind. J. Med. Res.*, xvii, no. 1, pp. 253–254, 2 refs. Calcutta, July 1929.

Barraud (P. J.). **A Revision of the Culicine Mosquitoes of India. Pt. XXVI. The Genera** *Heizmannia, Haemagogus, Topomyia* **and** *Megarhinus*.—*Ind. J. Med. Res.*, xvii, no. 1, pp. 259–280, 2 pls., 1 fig. Calcutta, July 1929.

Sinton (J. A.). **A Bibliography of Malaria in India.**—*Rec. Malaria Surv. India*, i, no. 1, pp. 1–200. Calcutta, October 1929.

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